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AN UNREASONABLE REDUCTION OF TELEPHONE RATES.

The Council Committee on Gas, Oil and Electric Light of the City of Chicago, after a lengthy investigation of the affairs of the Chicago Telephone Company, has decided to adopt the report of its expert recommending a reduction in the rates charged by the corporation for telephone service. The expert for the council committee has appraised the value of the company's physical property at a much lower figure than that deemed fair by the company, has assumed that the amount paid to the American Telephone & Telegraph Company for the rental of instruments is excessive, and has recommended that the surplus, $216,000, should be absorbed by a reduction in the rates.

The question of the reasonableness of the method adopted by the expert in the appraisal of the physical value of the company's property has already been discussed in these columns. The recommendation to absorb this comparatively small surplus, considering that the company has over 220,000 subscribers, is worthy of analysis and discussion. Due to excellence of construction of its outdoor equipment and the utilization of a great mileage of underground conduit, the company is not likely to suffer so disastrously from weather conditions as are similar concerns in other parts of the country. There are, however, a great many contingencies which might involve the use of the entire surplus.

According to Mr. B. E. Sunny, president of the Chicago Telephone Company, the report adopted by the committee makes no provision for the great cost which will be imposed upon the company for installing its conductors in subways when they are built, and the city is committed to this. There is no provision for the increased cost of material used in upkeep and for the increased cost of labor in operation, the city has practically granted a franchise to a competing company, and there is no provision made for the falling off in revenue that is likely to occur when this competition becomes in any way extensive.

An interesting commentary on this situation is found in a report of a decision by the Supreme Court of the State of Oklahoma involving the reasonableness of rates charged by a telephone company. This decision is quoted quite fully on other pages of this issue. The Court holds

that in valuing the property of a public-service corporation dedicated to the use of the public, such valuation should not be limited to the value of the physical tangible property so used, but must include the value of the property as a "going concern." A complete telephone plant without a single subscriber or with but a few subscribers is less valuable to both the owner of the plant and to the members of the public it serves than the same plant with a large patronage. The more people a subscriber can communicate with through a telephone exchange, the more serviceable, as a general rule, is such exchange to him, and it is only when such exchange has such subscribers that the property of the owner invested therein has an earning power. But subscribers are not obtained without expenditure of money, labor and time, during which the capital invested in the plant earns nothing and often fails to pay operating expenses.

If rates were to be charged from the beginning so as to cover this expenditure for development and earn a dividend from the time the plant is first operated, the rates to the first customers would be in many instances, if not in all, so exorbitant as to be prohibitive, and would be so at the time when the plant could be of least service to them. If the law requires that a portion of the investment shall never yield any return, but shall be a total loss to the investor, capital would unwillingly be placed into such classes of investments.

In a very comprehensive paper read by Mr. C. G. Young, of New York City, before the Central Electric Railway Association at Indianapolis, on January 19, entitled "A Logical Basis for Valuations of Interurban Railways," a similar point is brought to the fore. To secure the building or extension of a public utility requires capital. For perfectly evident reasons this capital does not seem to be forthcoming for such enterprises at the present time. It therefore behooves both the general public and the corporations to carefully consider fundamental conditions. To secure capital for the construction of a public utility it is usually necessary to make a carefully considered examination, and a report, by competent and experienced engineers in whom the investor has faith, that the property would probably earn double its fixed charges. The investor requires bonds for his investment, and if they be five-per-cent gold bonds they must be issued to him in considerable discount in order to give him a return of perhaps six per cent on the bonds, and as this return is not guaranteed he will require, in addition, a considerable portion of the common stock as a bonus to justify the risk he takes by investing before the actual earnings are demonstrated. In other words, the investor requires and is entitled to receive, if earned, a return in excess of six per cent to offset his risks of not receiving the nominal earnings on the bonds, bringing him much less than six per cent.

If such restrictions are placed upon the earning capital of seasoned securities that it does not seem reasonable that an adequate return can be made to the investor, how can any one reasonably expect that capital will be put into the development of public utilities that are urgently necessary and which develop the communities which they serve at an immeasurably greater ratio of profit and convenience than can possibly accrue to the investors in the public utility? These are phases of regulation of public-utility corporations which must be given consideration, and any valuation of property and regulation of rate which is not based upon a full recognition of these elements is unwise and is bound to react to the impairment of the service, the frightening off of capital for new investment, and the commercial decadence of the community.

EXTENDING SOUTH AMERICAN TRADE.

The Chicago Association of Commerce has planned to send a permanent representative to the Argentine Republic to look after the interests of manufacturers and exporters of Chicago and her industrial environs. This shows commendable commercial enterprise. This representative will have an office in Buenos Ayres, and should be an important factor in extending trade in that part of South America. His efforts could undoubtedly have had far greater results if his advent had been prior to the recent exposition in that city and suitable exhibits of our manufactures had been displayed at that time.

We have repeatedly called attention in these columns to the opportunities which are open to electrical manufacturers in South American countries. At present only about ten per cent of their trade comes to the United States, while England and Germany each get a large share. Mr. Charles H. Sherrill, United States Minister to the Argentine Republic, has stated his belief that a slight effort on the part of manufacturers here will bring the major portion of the trade to our markets. Other authorities have expressed a similar conviction.

It is very desirable in Argentina and other southern countries to protect trade interests by means of a trademark registered in that country, and with an American representative on the ground, this should be accomplished with little trouble or delay. Some regular advertising in the local mediums should be inaugurated. Calendars printed in Spanish would form useful advertising placards. It is necessary to extend credit to importers, as it is not customary to make any payments in advance, or in fact until three or four months after shipment.

The tariff upon dynamos, motors, lamps, telephone apparatus and electrical supplies, is, in most of the South American countries, low, and the field is open. The general sentiment towards this country has improved in recent years, and some persistent, enterprising effort on the part of manufacturers and exporters, with personal representatives upon the ground, will undoubtedly bring commensurate results.

Chicago is to be congratulated upon the move that has been taken, and electrical manufacturers both here and in other centers should see to it that they are in the van of the business-getting procession.

LEGISLATION ON ELECTRICAL UNITS.

In the circular announcing the change in the value of the international volt, reviewed this week among our NEW PUBLICATIONS, the Bureau of Standards calls attention to the changes chronicled in these pages three weeks ago, and states that Congress will be asked to repeal the act of 1894 and redefine the fundamental electrical units in accordance with the resolutions of the London Conference of 1908.

The London Conference adopted definitions of the international ohm, international volt and international ampere which are practically equivalent in value to those of the International Electrical Congress in Chicago, 1893, and consequently to those defined by the act of Congress referred to. The specifications attached to the old definitions are, however, now obsolete, and moreover the concrete value of the volt was expressed in terms of the Clark cell, which was then regarded as a working standard. The Clark cell has become an object of historical interest, mainly, and it is undesirable that the law defining the units should refer to it as occupying the position of a national standard. Even if a Clark cell be used to maintain a standard of electromotive force, the old specifications drawn up by a committee of the National Academy of Science do not represent approved modern practice.

Similarly the specifications for the silver coulometer have become archaic, especially since it has been discovered that the presence of filter paper influences the deposit of silver.

The London Conference left it to an International Committee to determine specifications for the use of the silver coulometer and the construction of standard cells, the normal Weston cell (using a saturated solution of cadmium sulphate with cadmium electrode, in place of the zinc sulphate and zinc electrode of the Clark cell), being recognized as a standard for maintaining the volt, its value to be determined from the international ohm and international ampere according to the definition. Without waiting for every detail of the specifications to be worked out, this committee has decided upon the value of the Weston cell, which will be in conformity with the definition of the London Conference, and this value (1.01830 volts at twenty degrees centigrade) is being substituted for the values formerly used by the countries participating in the international agreement. As previously announced, this value went into effect in the United States and Germany on January 1, 1911. Reports from the other countries involved have not yet been received.

Fortunately for the state of affairs in this country, the new value assigned to the normal Weston cell is in better agreement with our legal definitions than the value formerly used at the Bureau of Standards. A change in the law is desirable, not to enable us to conform to the values of the international units, but to put the definitions in a form more appropriate to our present knowledge of the conditions affecting the operations involved; to remove the ambiguity incident to the statement of a concrete equivalent to the international volt now known to be inconsistent with the primary definition; and to wipe out the specifications which have become obsolete and are no longer made use of.

While it is desirable that Congress should repeal the old law and adopt the newer definitions, it might be well to leave such features as specifications to an executive proclamation, subject to revision at any future time when it is found desirable through the advances in the art. The Government would then be free to participate in future international congresses with power to act, to a limited extent, and not merely with power to report to Congress.

While considering legislation affecting units of measurement, it would be well for Congress to pass an act legalizing and defining the international candle. This unit has at present no legal status in this country, as Congress is the only body with authority to fix the standards of weights and measures, and Congress has never determined any units of illumination. This is an unfortunate condition and it is rather surprising that no litigation has resulted from it in regard to the fulfillment of contracts; for until the recent adoption of the international candle, the standards of light maintained at different laboratories were decidedly different. The Standardization Rules of the American Institute of Electrical Engineers specify the unit maintained by the Bureau of Standards, but, of course, no one is legally bound by the Standardization Rules unless they are specifically mentioned in the contract. It would be more to the point to refer to this standard directly.

It is consequently highly desirable for Congress to fix standards and units for the measurement of illumination. While there may not be complete agreement as to what should constitute a primary standard of light, there should be no trouble, as in the case of electrical units, in adopting a concrete standard for practical work. It might be advantageous here again to leave certain specifications to executive promulgation, but an enabling and defining act should in any case be passed by Congress.

The importance of a consideration of the reflecting properties of wall and ceiling coverings and decorations is brought to attention by the timely paper by Mr. Paul F. Bauder, read before the recent meeting of the New York Section, Illuminating Engineering Society, and given in nearly complete form on other pages of this issue. While this subject has received some notice from specialists, too little consideration has been given to it by those in charge of decorating and illumination schemes.

Canadian Association Joins N. E. L. A.

At a meeting of the Canadian Electrical Association, held at the Prince George Hotel, Toronto, on January 20, it was voted to become a section of the National Electric Lamp Association. This vote was unanimous.

This accession to the Association carries its membership above 6,500, a gain of about 1,250 since the St. Louis convention last year. This number is expected to reach 8,000 by the next convention.

New company sections are being formed in Pittsburg, Allegheny, Scranton, Connellsville and other cities, and a number of smaller central-station companies have recently joined.

Chicago-Milwaukee Through Service

The Chicago-Milwaukee electric line and the Northwestern Elevated Railroad are to be united in a new corporation, and passengers will be carried, without changing cars, from Milwaukee into the loop district of Chicago. The movement is being promoted by A. C. Frost, president of the interurban company, who states that the bondholders who forced the receivership will exchange their holdings for stock in the new company.

Mason B. Starring, president of the elevated railroad company, will head the new corporation and the board of directors will be the same as the present board of the elevated company. Present mortgages on the interurban line are to be foreclosed and $3,500,000 in new bonds issued.

Telephone Rates in Chicago.

The order of the City Council of Chicago directing its expert to draw up a lower schedule of rates has been declared by President B. E. Sunny to be unfair and a statement has been made by him that the lower rates would not be accepted by any chance.

This decision of the Council as to rates is the outcome of the report made by W. J. Hagenah, chief telephone expert of the city.

The committee adopted the recommendations of its investigators fixing the value of the Company's plant at about $22,000,000, reducing the payments to the American Telephone & Telegraph Company $147,000, establishing a depreciation fund of five and one-half per cent and a dividend of eight per cent, and distributing a surplus of $216,168 by a reduction of rates.

"The operation of the Company on this basis," protested President Sunny, "will take the last penny out of its treasury. Besides cutting out $216,000, it shrinks the actual value of the Company's property by $5,000,000. A corporation doing an $8,000,000 business should be allowed a surplus of about $500,000. The dividends, when figured on the Company's capital stock of $27,000,000, shrink to 6.6 per cent."

Meeting of the Philadelphia Electric Company Section.

The regular monthly meeting of the Philadelphia Electric Company Section of the National Electric Light Association, was held on Monday evening, January 16, 1911. Dr. Spitzka was to have made an address on "The Effects of Electricity On the Human Body," but unfortunately he has had a very serious illness and it was necessary to postpone his address to some future date. A paper by G. Bertram Regar on "Incandescent Gas Lighting" was substituted.

The meeting was of special interest on account of the presence of the national president and national secretary, Messrs. Freeman and Martin, as well as Mr. Seelman, editor of the national Question Box; Messrs. Granger and Orr, president and vice-president of the Pennsylvania Electric Association, and Messrs. Baily, White and Kemble, of the Brooklyn Section.

The paper of the evening proved to be most interesting to the electrical interests. Mr. Regar outlined the progress of incandescent gas lighting from its earliest form to the most modern appliances; the various stages being thoroughly described and illustrated with lantern slides. The methods of ignition were treated and the paper concluded with a summary of the advantages and disadvantages of gas lighting. which will prove of inestimable value to the electric solicitor. Mr. Regar's intimate knowledge of the gas industry is the result of a long connection with gas-lighting interests, and therefore his comparison between electricity and gas lighting could be considered authentic. In the discussion which followed many points were brought out, and the actual experiences of electrical solicitors were related.

W. W. Freeman, the president of the National Association, was then called upon, and made a most interesting address.

Boston Syndicate Takes Over the Long Acre Electric Light & Power Company.

The control of the Long Acre Electric Light & Power Company, New York, N. Y., has been purchased by a syndicate of Boston financial people and it is understood that plans have been agreed upon to increase the capitalization and underwrite bonds to the extent of $10,000,000 for the building of a much larger plant and the installation of a distribution net work. The Company now has a plant at Forty-seventh Street and Second Avenue. Ex-Senator James F. Shaw, of Boston, has been elected president of the Long Acre Electric Light & Power Company.

Mr. Shaw was president of the American Street and Interurban Railway Association (now the American Electric Railway Association) in 1909 and 1910. He has been connected with electric railroading since 1893, and many of the railways in which he was interested are now embodied in the Massachusetts Electric system. He was a member of the Massachusetts Senate in 1907, 1908 and 1909.

The Long Acre Electric Light & Power Company was incorporated on April 21, 1903, in New York, as successor to the American Electric Light Company, securing its franchise to supply electric light in the boroughs of Manhattan and the Bronx. On January 19, 1907, the Appellate Division of the Supreme Court affirmed the decision of Justice Dowling, granting a peremptory mandamus to compel the Consolidated Telegraph & Electric Subway Company to permit the Long Acre Electric Light & Power Company the use of its conduits for a cable of three conductors in its subway from 548 West Forty-second street to Seventh Avenue and north to Forty-fourth Street and Broadway. The decision was affirmed by the Court of Appeals on April 30, 1907.

The syndicate has been represented in this negotiation and its examination of the affairs of the company by Samuel Untermyer, while the company had the services of Graham, L'Amoreaux, Dittenhoefer, Gerber & James, and Simpson, Thatcher & Bartlett.

James F. Shaw.

The acquisition of control of the Long Acre Electric Light & Power Company of New York, N. Y., by a syndicate of Boston people and the announcement that James F. Shaw, of Boston, had been made president, has created considerable interest in electric-railway and electric-lighting circles. Mr. Shaw has long been associated with electric-railway interests and has demonstrated marked ability as an executive and organizer. Twice elected president of the American Street and Interurban Railway Association, the name of which has recently been changed to American Electric Railway Association, he has come before the electric-railway interests of the country as an exponent of progress and as a champion of the rights of public utilities to secure from the public an adequate appreciation of the risk and effort involved in the upbuilding of these great arteries of commercial intercourse.

Mr. Shaw's papers on this subject have attracted universal attention and he must be credited in great measure with the success of the policy coming squarely before the people with full information respecting the operations for public utilities and the fostering of good will between the corporations operating these utilities and the public whom they serve.

Mr. Shaw was born in Newburyport, Mass., in 1873, receiving his early education in the public schools. In 1891 he entered the employ of the Newport Car Company, first in the shops and afterward in the office. His first electric railway connection was with the Black Rock & Salisbury Beach Street Railway Company, as superintendent, in 1891. He served the road in this capacity, which was operated only in the summer months, in 1891 and 1892, in the interim devoting his time to his interests in the electric railway supply business. Since 1893 he has been connected with many electric railways and has been prime mover in the construction and operation of more than 600 miles of electric railway track, representing an investment of $16,000,000. This mileage included some twenty-five distince railways, connecting many municipalities scattered throughout the counties east of and including Worcester, Mass. Many of these lines are now part of the Massachusetts electric system. When he was twenty-five years of age he was president and general manager of thirteen different electric railways.

JAMES F. SHAW.
President of the Long Acre Electric Light & Power Company.

He has been a director and president of savings and trust companies, director of coal mining companies, and has been interested in cotton mills. His special public activity, however, has been in connection with the affairs of the American Electric Railway Association.

Mr. Shaw is prominent in Massachusetts politics and was elected to the Massachusetts Senate in 1907 and re-elected in 1908 and 1909. While in the Senate he served on the Committee of Rules, Ways and Means and Military Affairs, being chairman of the Committee on Military Affairs for two years and chairman of the Ways and Means Committee During the 1909 term.

Chicago Electrochemists Hold Meeting.

The first meeting of the newly formed Chicago section of the American Electrochemical Society was held on the evening of January 20. The subject for the evening was the electric refining of steel and papers were presented by James Lyman, F. T. Snyder, C. F. Burgess and C. G. Osborne.

Mr. Lyman referred to the limitations of the old methods for making steel and the possibility of the electric furnace for furnishing steels of any desired composition. Both arc and induction furnaces for the production of pig iron and steel were considered and considerable data bearing on these processes was given. Various types of furnaces were described and illustrated with lantern slides.

Mr. Snyder referred to the Siemens arc furnace of 1880 as the pioneer furnace for steel making and then discussed the different elements which go to determine the reliability of the furnace for practical work. Commercial reliability requires that an apparatus should be to a certain extent self-regulating (that is, operable by unskilled men), that appropriate supplies shall be available and that the work be done in a reasonable time.

Professor Burgess spoke of the commercial possibilities of iron purified by electrolytic processes, which he has been carrying out. A large cathode obtained by this method was shown and it was stated that a purity of 99.97 per cent was obtained.

Mr. Osborne described the construction and operation of the Heroult furnace of the Illinois Steel Company, giving details of the time of operation and showing charts of the variation in composition during the process of refining. The ultimate strength of the product is found to be greater than that of open-hearth steel, while the elongation is decreased.

The Telephone Situation in Chicago.

At the regular weekly meeting of the Chicago Electric Club on January 18, the names of officers for the present year were submitted to the Club by the nominating committee. Secretary Hickok, who read the report, named the following officers: Homer Niesz, president; C. A. Howe, vice-president; N. F. Obright, secretary; Otis B. Duncan, treasurer. The board of managers nominated consisted of John W. Mabbs, H. A. Mott, A. L. Millard, George H. Jones and W. R. Bonham.

The speaker of the occasion was H. D. Critchfield, of the Automatic Electric Company, who outlined the situation in the telephone field as it exists at present in Chicago. The value of Mr. Critchfield's remarks was attested by the general interest with which they were received.

Mr. Critchfield outlined briefly his views on the telephone situation, making two or three comparisons regarding the service. The Chicago Telephone Company with the 240,000 telephones which are to be in use has, he stated, reached its present state of development after thirty-three years of established business. There are at present about 100,000 lines in more than thirty exchanges scattered throughout the city, between which exchanges there are trunk lines involving a second operator. In comparison with this long established business, the Automatic Company began on May 6, 1910, with the rehabilitation of its system, and at present there have been signed 37,000 contracts for undivided service, which represents more than one-third of the business secured by the Chicago Telephone Company in more than thirty years. These 37,000 lines will accommodate or may accommodate eventually three times as many subscribers. There are now eight exchanges, four of which are in the loop district. There are twenty-seven miles of trench dug outside of the loop and there are sixty-two miles of tunnel. The time which was given in the Telephone Company's franchise for the installation of 20,000 telephones was June 1, 1911, and from the present outlook it seems certain that the required number will have been reached before April 1. At present only three weeks of actual installation work has been done and there are 3,900 telephones in actual operation. Instruments are being cut in at the rate of 260 a day, and within sixty days this rate will be more than doubled.

The growth of the system, however, will not be limited to 20,000 subscribers, but can reach almost any number, and the rate to subscribers will remain the same.

Mr. Critchfield stated that he believed the service given at present by the Chicago Telephone Company is as good as that of any other manually operated telephone system in the United States, but, on the other hand, he contended that it is impossible for any manually operated system to give as good or as cheap service as is possible with an automatic installation.

From last year's report of the Chicago Telephone Company the pay roll in the exchanges was shown to be approximately $1,346,000 per year, with 200,000 telephones as a basis. Other employees are paid $180,000 and $60,000 additional was the cost for superintendents, making a total of nearly $1,500,000. From data based on his long experience with both manually operated and automatic plants, he estimated that the same service could be given with automatic telephones for less than $350,000 per year. The operating cost alone would be about $1,153,000 less with the automatic than with the equivalent manually operated service. This excess cost amounts to about six per cent per annum on the total investment of the Chicago Telephone Company, or twenty-four per cent on the total operating charges. The efficiency with a large telephone system is also a subject for consideration and the time of connection with automatic systems of about six seconds will not be increased with any number of lines.

Mr. Critchfield mentioned especially the equipment of the Grand Rapids Telephone Company, where 4,500 automatic telephones were installed in 1902. Rigid contracts were made with the City, one clause in which related to satisfactory service and another to replacement of worn parts. At the end of seven years the Automatic Company was to replace all parts which in any way showed the use of wear and when the inspection of the plant was made in January of this year it was found that the total expense of replacement was only a little more than $900.00. There are at present 11,000 telephones in operation in that city.

Meeting of Philadelphia Section, Illuminating Engineering Society.

A meeting of the Philadelphia Section of the Illuminating Engineering Society was held on the evening of January 20. The meeting was preceded by a dinner held at the Hotel Continental, attended by 30 members and guests, an entertaining feature of which was the recitations of Messrs. Granville and Monville. The meeting proper convened as usual in the rooms of the Philadelphia Electric Company at 8 p. m., with William J. Serrill in the chair, and eighty-five in attendance. The paper of the evening, "Acetylene Buoy Lighting," by David Ahldin, was read by the author. The paper covered one particular type of acetylene lighting and contained much that was both interesting and instructive. The acetylene gas is stored in tanks under ten atmospheres in the presence of acetone and 5,000 candlepower-hours can be obtained per cubic foot of tank.

The system has two features of great importance, one being the rapidity with which flashes may be obtained, the shortest covering 0.1 second. The other feature is the automatic device controlling the lighting, so that during daylight or sunlight the light is extinguished and during fog or during the night it is lighted. The apparatus used to obtain this result consists of two metal rods with equal co-efficients of expansion, one being painted with a light-absorbing coating and the other with a light-reflecting coating. During sunlight or daylight the rod painted black expands and closes the gas outlet. It is estimated that the so-called sunvalve will show a saving of forty per cent in the quantity of gas used. The most commendable feature of the paper was the display of apparatus in use. The discussion which followed by Messrs. Serrill, Aaron, Morton, Owens and others was not of the critical order.

Secretary George Muth announced the following papers for future meetings:

February Meeting. — "Sun Light *versus* Artificial Light For the Taking of Moving-Picture Films," by Edward L. Simons. This paper will be a description of the method followed in making moving pictures in the immense Lubin Studio located in Philadelphia.

March Meeting.—"Spectral Lines as Standards of Luminous Values," by Herbert E. Ives.

Electricity in a Huge Mail-Order Establishment.

Installation at the Plant of Sears, Roebuck & Company.

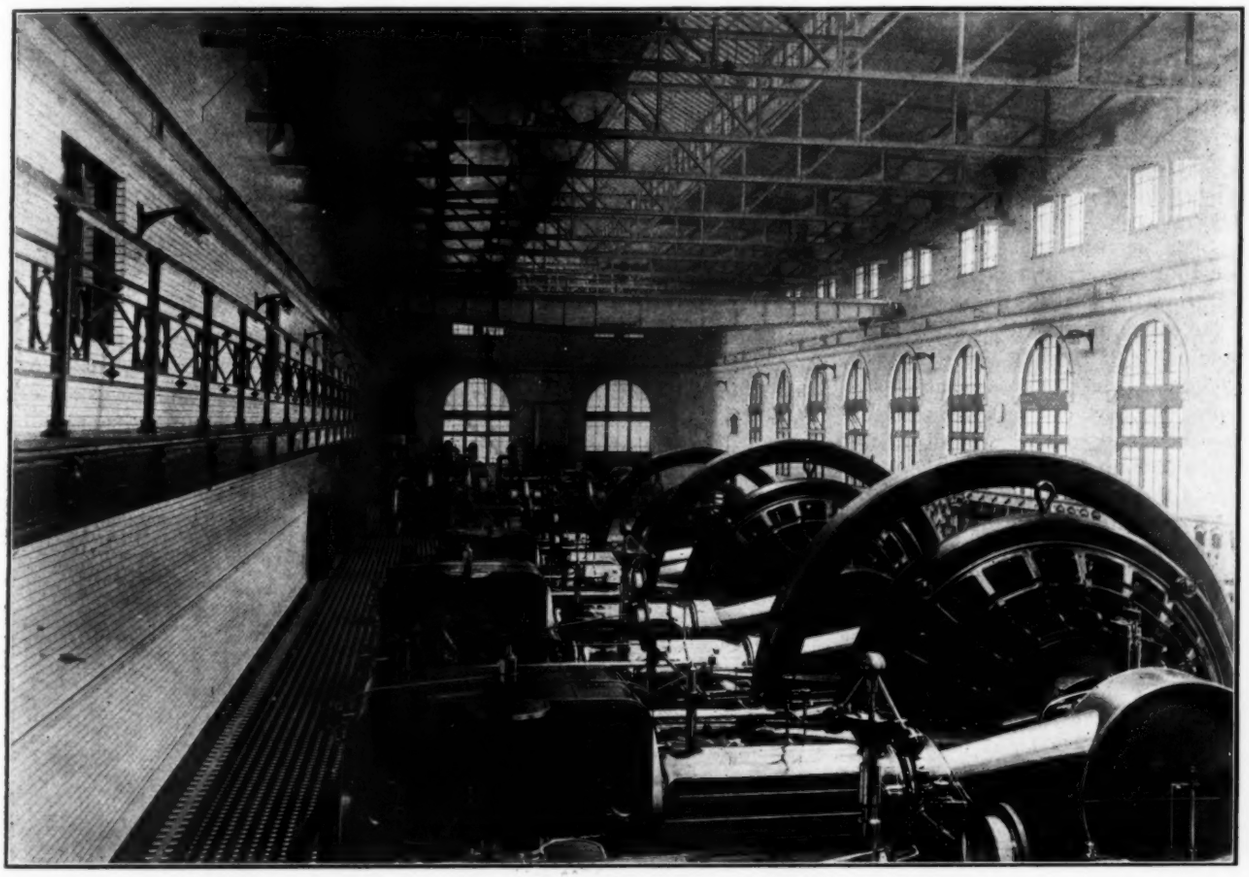
As an indication of the importance of electricity as a potent factor in the economical and efficient operation of a giant merchandising establishment, the plant of Sears, Roebuck & Company, Chicago, Ill., is unique. This huge plant, which covers an area of forty acres, is equipped with every modern convenience known in present day engineering practice. For the proper heating, lighting and ventilating of the various buildings, for the prompt and accurate dispatch of the volume of written orders, letters, etc., for transferring merchandise from different departments to the packing and shipping rooms, for operating the machines of a model printing plant, and for innumerable special purposes, electrical energy has been exclusively employed.

Although the company has been located in its present quarters for a number of years there have recently been made a number of important additions and changes both in buildings and power-plant equipment so that a description of the electrical and mechanical installation at this time is apropos.

The plant of Sears, Roebuck & Company is located on the west side of the city on a forty-acre tract of land, bounded by Central Park Avenue on the west, Kedzie Avenue on the east, Fillmore Street on the south and Harvard Street on the north. The buildings comprised in this tract are six in number, each designed for a special purpose. Starting at the extreme west corner is the merchandise building, with the new warehouse adjoining it on the south, the next building east is the administration building and the printing building is located at the southeast corner of the tract.

The power plant is located adjacent to the south side of the administration building and on the main line of the Chicago Great Western Railroad.

The enormous amount of power, heat and light required in this group of buildings made it necessary to construct an isolated power plant, which has subsequently come to be regarded as one of the largest and most complete plants of its character in existence. An idea of the requirements imposed on this plant may be gained from the report of the chief electrician, which states that the total current consumption of the entire establishment for the past twelve months has been approximately 4,685,400 kilowatt-hours, while the current consumed in the printing plant alone, for a period of six months, was 194,430 kilowatt-hours.



GENERAL VIEW OF POWER PLANT, SEARS, ROEBUCK & COMPANY, CHICAGO, ILL.

As already stated the power plant occupies a position adjacent to the administration building and approximately in the center of the tract of land occupied by the company. The building, covering an area of 30,000 square feet of space, is absolutely fireproof,

constructed of steel, concrete and brick, and was especially designed to receive the special apparatus and machinery required. All of the generating apparatus, boilers, engines and part of the pump equipment are located on the first floor, while the connecting pipes, ash-handling apparatus, pumps, etc., are located in the basement.

At the power plant of Sears, Roebuck & Company extensive provision has been made for the automatic handling of coal. A spur track of the Chicago Great Western Railroad is run adjacent to the south wall of the plant. This track is equipped with an automatic scale and after being weighed the coal is dumped into chutes, which convey it to a crusher operated by a fifteen-horsepower motor. This crusher empties onto a belt conveyor, which carries the coal to the southwest corner of the plant, where it is taken by bucket conveyors to the coal bunkers over the boiler room. A five-horsepower motor operates the belt conveyor and a fifteen-horsepower motor is employed for operating the bucket conveyor.

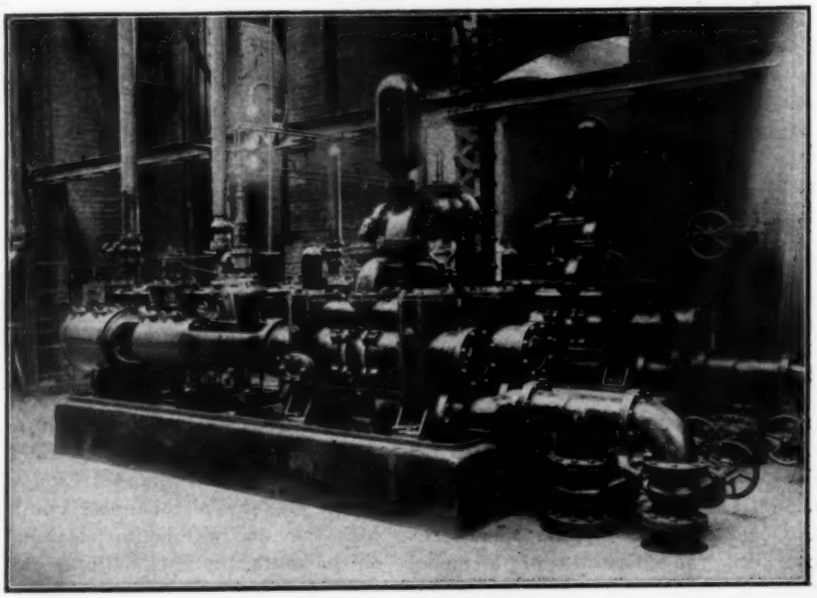
The entire plant is divided by a longitudinal wall running east and west, extending from the basement to the roof. The northern section is the engine room and consists only of a basement and main floor. The southern section is the boiler room with basement and a floor above the boilers, equipped as coal bunkers. Coal is emptied from the bucket conveyors into a portable dumper, which distributes it to the bunkers over each boiler. Each of these bunkers has a storage capacity of 100 long tons.

The boiler equipment of this plant comprises twelve 500-horsepower water-tube boilers located in a single row and divided into batteries of four each. The boilers, which are of the Aultman-Taylor manufacture, have a heating surface of 5,000 square feet each, and each is equipped with a superheater.

The furnaces are provided with traveling chain grate stokers, each having a grate surface of ninety square feet. Two Wachs 8 by 8 engines are employed for operating the stoker main shaft. Coal is admitted to the stokers through spouts connected to the coal bunkers. Two of the furnaces are equipped to burn refuse from the offices.

Ashes are dumped from each furnace onto a belt conveyor, which empties into a bucket conveyor. This latter conveyor carries the ashes to the southeast corner of the upper floor, where they are dumped into railroad cars through steel chutes. The coal and ash-handling machinery has a capacity of 100 tons per hour. An interesting feature of the boiler-room installation at this plant is the fact that only two men are required to operate it—one man having charge of six boilers with the corresponding auxiliary apparatus.

BOILER INSTALLATION.



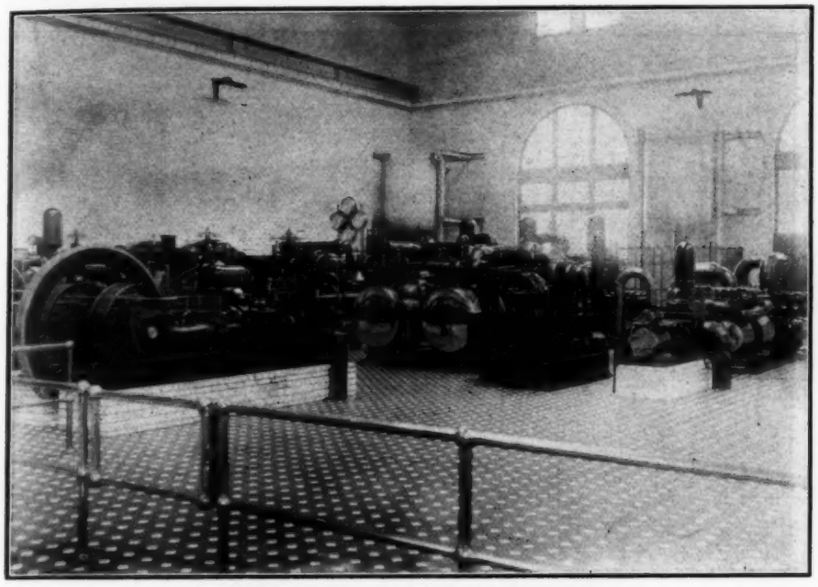
VIEW OF BOILER-FEED PUMPS.

Located between the two batteries of boilers are the boiler-feed pumps. There are two of these pumps, each 10 by 16 by 8.5 by 18, of the compound duplex type, furnished by Fairbanks, Morse & Company. Each pump is controlled by a Fisher governor.

The steam piping has been designed to take care of any emergency that may arise. Six-inch bends connect each boiler with the main header, which is sixteen inches in size. This main header is looped in the engine room so that either four boilers may supply any of the engines. The exhaust from the engines is conducted to a thirty-six-inch exhaust header, which is connected to two Austin oil separators. The exhaust steam is then passed into an expansion tank, and when necessary is mixed with live steam for the heating system. In

summer when the heating system is not in operation the exhaust steam is passed to atmosphere.

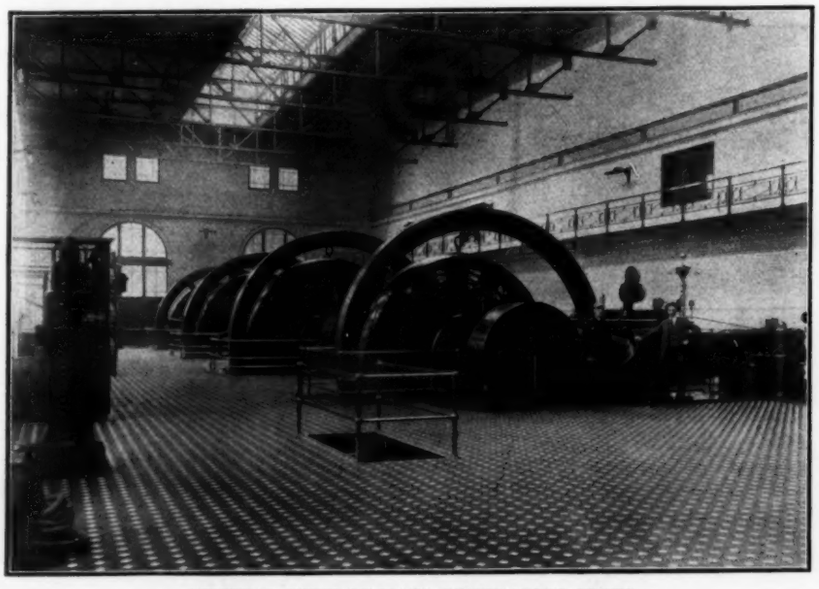
One of the unique features of this power plant is its towering chimney, which furnishes the requisite draft for the boilers. This chimney is constructed of radial brick. It is 250 feet high, fourteen feet in diameter, and is supported on concrete caisson foundations sixty feet in depth, the height from bed rock to crown being 310 feet. The weight of this smoke stack is 2,500 tons.



GENERAL VIEW OF PUMP INSTALLATION.

Located in the basement of the boiler-room section there is installed a twenty-ton Carbondale ice machine, which is used for manufacturing ice for the restaurants, drinking-water supply, etc. Adjacent to this machine there is a house-service pump, operated by a thirty-five-horsepower Bullock motor, which pumps the drinking water from the main reservoir.

The engine room is extremely ornamental, finished throughout with white-enameled brick with red English tile floor, and a spacious visitors' gallery along the north wall. The entire power plant is designed and laid out to permit of the greatest economy in its mechanical operation.



GENERAL VIEW OF MAIN GENERATING UNITS.

The entire western section of the engine room is taken up with the pump installation. This equipment comprises two 16 by 22 by 20 Marsh vacuum pumps for the heating system; two 8 by 12 by 8 by 18 steam house pumps; one two-stage 10 by 18 by 11 by 12 air compressor, having a capacity of 300 cubic feet per minute, for vacuum cleaning purposes, conducting refuse to the engine room, etc.; one two-stage air compressor for the pneumatic-tube system; three compound-duplex elevator pumps, one high-pressure fire pump and several smaller pumps for miscellaneous service. A view of the pump installation is shown in one of the accompanying illustrations.

The generating units and switchboard occupy the remainder of the engine room. Situated in a single row in the center of the room are the four main units. Beginning at the east end the first three are 24 by 50 by 48 cross-compound Allis-Chalmers Corliss engines direct connected to three 750-kilowatt, 220-volt direct-current Bullock generators. The fourth unit comprises a 20 by 40 by 42 cross-compound Allis-Chalmers Corliss, condensing engine direct connected to a 500-kilowatt, 220-volt Bullock generator. The three large units operate at a speed of eighty-five revolutions, while the small unit operates at a speed of ninety-five revolutions per minute. Each engine is equipped with a Richardson automatic oil pump.

For supplying current to the extensive fire-alarm system, buzzers, alarm-bells and graphophones there are provided in the engine room two low-voltage generators, these circuits being carried independently throughout the entire plant. The low-voltage units are located adjacent to the pumps, on special foundations, removed from the main units. They comprise a 12 by 12 Ames simplex engine driving a fifty-kilowatt, twenty-volt generator and a 14 by 14 Ames simplex engine driving a 100-kilowatt, twenty-volt generator.

The main switchboard is a model of its kind. It is located adjacent to the north wall of the plant and is of the standard angle-iron frame construction. There are twenty panels of blue Tennessee marble about one inch thick. Each panel is equipped with the latest controlling, measuring and regulating apparatus, including integrating watt-

meters, recording wattmeters, station voltmeters, etc.

All leads from the generators are run in iron conduit to the basement, where they are grouped and conducted to the switchboard. The board is equipped with two sets of main busbars, which are interchangeable, in case of accident. All power circuits are controlled from panels on the left of the board and all of the lighting circuits are controlled from panels on the right side.

The engine room is equipped with a gravity oiling system, all oil being pumped to a tank in the southeast end of the boiler room over the coal-conveying machinery. A twenty-five-ton traveling electric crane spans the engine room.

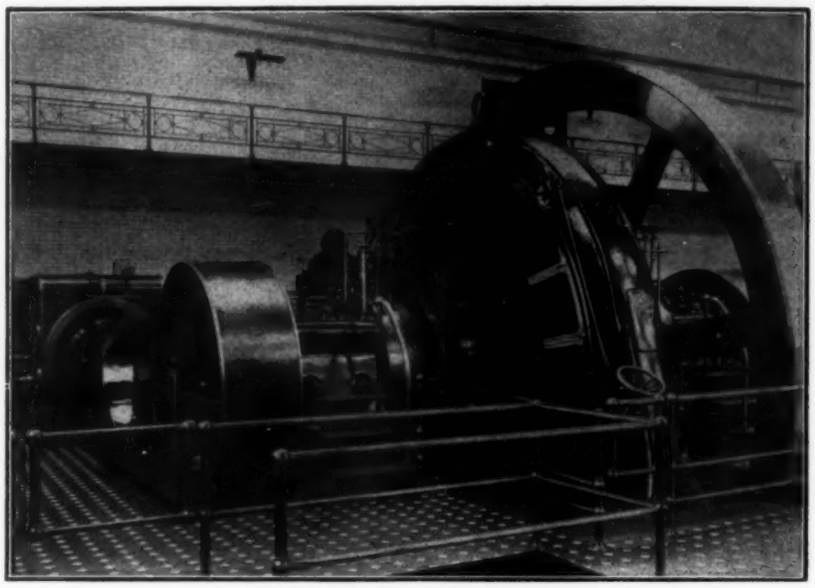
A comprehensive system of tunnels connects the engine room with all of the buildings. In these tunnels all electrical wiring, steam pipes, water pipes and refuse conveyors are run.

The heating and ventilating apparatus installed in the various buildings operating from the power plant is very elaborate and complete. The blast system employed in heating the building is so equipped that in winter time a uniform temperature is maintained, while in the summer time ventilation is furnished every part of the buildings by means of a supply of fresh filtered air. In conjunction with the blast system of heating there are used a number of steam radiators, placed around the more exposed portions of the rooms.

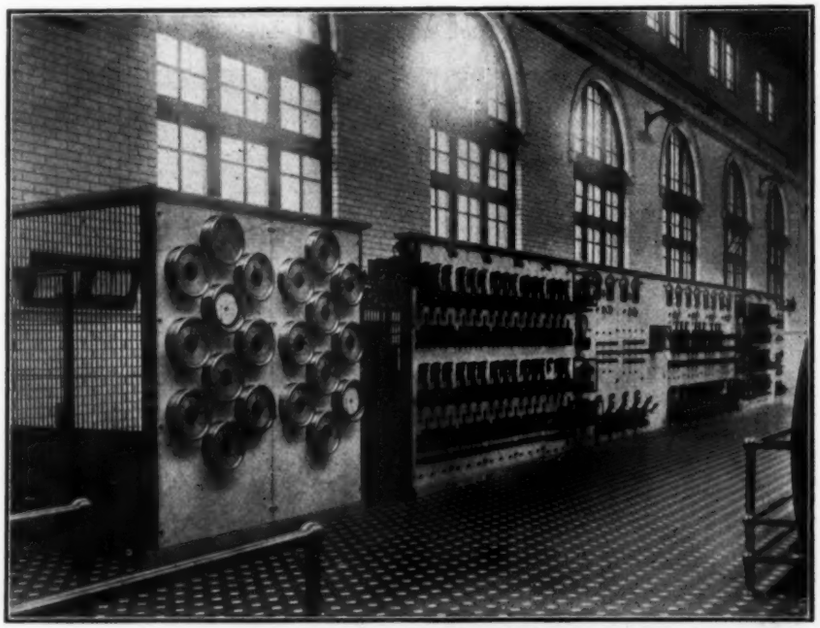
To describe the ventilating system it is necessary to state that owing to the size of the two main buildings—the administration and merchandise—they are divided into sections with fireproof dividing walls. At each of these dividing walls there is installed in a special air chamber a motor-driven fan, which supplies either cool air in summer or hot air in winter to the section in which it is installed. There are thirty-three of these fans, each operated by a twenty-horsepower motor. Fresh air intakes are located on the roofs over each section. Ducts convey the air to the ventilating chamber, where it is washed before being distributed through the buildings. In severe cold weather these intakes are closed and only heated air distributed.

Probably the most valuable time saver employed in the plant of Sears, Roebuck & Company, to facilitate the transaction of business, is the very elaborate system of pneumatic tubes used for sending written communications, orders, etc., between departments throughout the several buildings. More than fifteen miles of tubing are used in this system, which is said to be the largest of its kind in existence. Letters and orders are all received in the Administration building, where the central station is located, and are from there dispatched to the proper merchandise or clerical department. The carriers are of the cartridge type.

The motor installation in this establishment comprise a total of 480, ranging in size from one-half horsepower to 150 horsepower. In the printing building alone 125 motors are employed. The printing building is a modern fireproof structure, 250 feet long, 90 feet wide and four stories high, and is devoted exclusively to printing catalogues, stationery, etc., required by the company.



VIEW OF 750-KILOWATT UNIT.



MAIN SWITCHBOARD, SEARS, ROEBUCK PLANT.

The main press room is on the first floor and contains twenty motor-driven printing presses. Ten-horsepower motors are used for driving these presses,

which are also equipped with the central control system. In all other operations automatic machines are employed wherever possible and in every instance an electric motor furnishes the motive power. Among the more

VIEW OF TYPICAL LIGHTING INSTALLATION IN A DEPARTMENT.

important machines may be mentioned folding machines, trimming machines, assembling machines, job presses, etc.

There is also provided a complete electrotyping plant comprising motor-driven, trimmers, blacking machines, routers, saws, and motor-driven plating dynamos. As in other departments, the

EXTERIOR VIEW OF MERCHANDISE BUILDING AT NIGHT.

printing building is equipped with an elaborate system of conveyors for transferring the product from one department to another.

An interesting feature of the installation in the printing building is the equipment for handling the scrap paper. Convenient to the trimming machines there is located a huge spout into which all trimming from the catalogue are dumped. By means of compressed air this material is conveyed to a department in which the paper is bailed and returned to the paper mills.

As previously mentioned two of the boilers in the power plant are equipped to burn refuse. In this conenction there is installed in the basement of the merchandise building two grinding machines each operated by a 100-horsepower Bullock motor. In every department of the building there is provided a chute into which the refuse such as paper, boxes, catalogues, etc., is dumped. These chutes empty into a main bunker, equipped with an automatic door, and as needed this refuse is fed into the two grinding machines. This material is then conducted through ducts to the storage bin over the two boilers in the boiler room and fed to the stokers.

The lighting installation in the various buildings is one of the most complete and approved installations in an establishment of this character. The total equipment of lamps comprises eighty inclosed arc lamps, 3,000 tungsten-filament lamps, 6,200 Nernst lamps, 32,000 carbon-filament lamps and 200 Cooper Hewitt lamps.

In the majority of large rooms where many are employed single-glower Nernst lamps are almost exclusively employed. These are generally suspended about five feet from the ceiling by ornamental chains and are arranged in single rows spaced about ten feet apart. In other departments where conditions warrant it carbon or tungsten filament lamps are used. In the printing building and shipping department Cooper Hewitt lamps are employed. The eighty arc lamps are used only for exterior lighting and in the train shed.

In one department, Mr. Church, chief electrician of the plant, has made an installation of indirect lighting for experimental purposes. Sixty-watt tungsten-filament lamps are employed, installed in ornamental bowl reflectors. This installation has proved so satisactory that extensions of this system of lighting are being contemplated.

A feature of interest in the plant of Sears, Roebuck & Co. is the fire-protection system. The plant is equipped with a supervisory signal system which indicates at any time of night or day the condition of all the fire-protection apparatus. A complete electric fire alarm system is installed which registers in the engine room and fire alarm station only. At night, however, by turning in an alarm, every station would record the alarm.

The entire plant is under the supervision of A. F. Wright, chief engineer.

Advertising to Prevent Accidents.

The Indianapolis & Louisville Traction Company has taken a novel method of advertising, with the intention of reducing the number of accidents. In carrying out the plan, blotters bearing a list of the most common causes of accidents have been distributed among the school children in the vicinity of the company's lines.

Meeting of the Central Electric Railway Association.

With an attendance exceeding any previous meeting the sixth annual meeting of the Central Electric Railway Association was held in the Claypool Hotel, Indianapolis, January 19. The program consisted of the reading of papers, discussions, reports of standing and special committees and a general review of the work of the Association during the past year. The meeting was called to order at 10 A. M. by George Whysall, president, who congratulated the Association on the large attendance, stating that representatives of interurban roads were present from Ohio, Indiana, Michigan, Illinois, Kentucky and Canada. After the reading of the minutes of the previous meeting and electing seven new members, President Whysall introduced C. G. Young, consulting engineer of New York, who read a very interesting, instructive and exhaustive paper on the "Logical Basis for Valuation of Interurban Street Railways." This paper is given at some length following this report.

Mr. Young's paper was well received and in the discussion A. W. Brady, president of the Indiana Union Traction Company, said the paper was too exhaustive to discuss intelligently without preparation and suggested that it be taken up at some future meeting of the Association for a more thorough discussion. Mr. Brady referred to the debt of gratitude the people of this country owe to the investors who have put their money into interurban roads, making possible the great progress made in this country and especially in the Central States interurban transportation facilities. He said the investors are justly entitled to a fair rate of return and he thought it inconceivable for the public to deny this on the cry of watered stock.

The afternoon session was opened with a talk by Joseph A. McGowan, secretary of the Terre Haute, Indianapolis and Eastern Traction Company. Mr. McGowan said Indianapolis was proud to have such a body of interurban men hold their convention in its midst. He said he knew something of what the interurban development had done for the city and predicted that within another ten years the Central States would show a marvelous development in interurban roads. Mr. McGowan paid a tribute to the men engaged in interurban railroading and thought much credit is due to the men who invested capital in the roads, thus enabling them to be built. He said the value of the Association meetings consisted in the exchange of ideas, which was mutually helpful. Short talks were made for the good of the Association by Mr. Whitney, Mr. Hudson and James Anderson, of Windsor, Ontario. Mr. Anderson spoke of the pleasure and profit it afforded him to attend such a meeting. He said there was considerable interurban development in Canada and spoke in complimentary terms of the men who came to Canada from the United States.

George Whysall, the retiring president, said the work of the Association during the past year was gratifying to him. He said the Association had grown in interest, membership and finances. He reported that the Illinois interurban people had effected a temporary association for the purpose of disposing of some local matters, but would in a short time unite with the Central Electric Association.

A vote of thanks was given Mr. Young for his excellent paper and the outgoing officers were likewise given thanks for their excellent service.

The election of officers resulted in the selection for president of E. B. Peck, of Indianapolis, vice-president and controller of the Terre Haute, Indianapolis and Eastern Traction Company; first vice-president, W. S. Whitney, general manager of the Ohio Electric Railway Company; second vice-president, A. W. Brady, president of the Indiana Union Traction Company; and A. L. Necreamer, secretary.

Canadian Commercial Committee Meets.

The Commercial Committee of the new Canadian Section of the National Electric Light Association held a meeting on January 20 in Toronto, and Chairman Eugene Creed was instructed to communicate with the central stations who are members, asking for reports, contracts, special rates, methods of doing business, etc. This information will be incorporated in a report to be submitted to the Winnipeg convention.

Besides the chairman, those at the meeting were J. W. Purcell, P. F. Kelly, W. H. McIntyre and P. M. Grimes.

Over 1,200 electrical patents were issued in Great Britain in 1910. The total number of all kinds was 30,403.

LOGICAL BASIS FOR VALUATIONS OF INTERURBAN STREET RAILWAYS.[1]

BY C. G. YOUNG.

Much of importance has been said and written of a more or less contradictory nature on the subject of valuations of various classes of public utility properties, so that an analysis of the problem as affecting the investor, the public, the corporation and the government in respect to interurban street railways should be of interest to everyone seeking a fair and reasonable solution of the present perplexing problems involved.

The writer proposes to assume and maintain an independent attitude or position in dealing with the questions, believing that there is something to be said and acknowledged on both sides.

The great importance of the interurban electric railways as a convenience and necessity for the superdevelopment of this great nation warrants us in taking it as a fair basis for the consideration of the subject.

Today there are operating in the United States approximately 12,000 miles of interurban electric railways, representing an investment of probably $400,000,000. The net earnings are possibly $24,000,000, or six per cent on the investment, but not over seventy per cent of the net earnings can be paid out in dividends.

The net earnings from industrials will probably average not less than twelve per cent on the total capital invested.

There is in contemplated construction approximately 2,500 miles of additional interurban railways, every mile of which is desired by the public and which is conceded would add enormous definite financial values and advantages in the sections to be served.

To secure the building of any of these lines requires capital, which, for perfectly evident reasons, does not now seem to be forthcoming. It therefore behooves both the general public and the corporations to carefully consider fundamental conditions. To secure capital for the construction of an interurban electric railway, it is usually necessary to show, by carefully considered examination and report made by

[1] Abstract of a paper read before the annual meeting of the Central Electric Railway Association, Indianapolis, Ind., January 19, 1911.

competent and experienced engineers in whom the investor has faith, that the road will probably earn perhaps double its fixed charges. The investor requires bonds for his investment, and if they be five per cent gold bonds, they must be issued to him at a considerable discount in order to give him a minimum return of perhaps six per cent from the bonds, and, as this return is not guaranteed, he will require in addition a considerable portion of the common stock to justify the risk he takes by investing in a new property and before the actual earnings are demonstrated. In other words, the investor requires and is entitled to receive, if earned, a return in excess of six per cent to offset his risks of the actual earnings bringing him much less than six per cent.

PURPOSE OF VALUATION.

The different reasons for the valuation of a public utility property have brought about many divergent views held by different commissions as to the correct and basic method for making valuations. The following are some of the principal purposes that have been advanced for desiring a valuation of a property:

(1) To limit the bond issue to the physical appraisal. Probably first demanded by conservative bond dealers and investors, and is now covered by expert valuations made for them.

(2) To determine a basis for taxation. Corporations generally desire to limit such valuation to the present physical appraisal, while some commissions add franchise and non-physical value. Certain commissions use net earnings capitalized. A valuation would be unnecessary if a uniform method of taxation was adopted by taking as a basis a specific percentage of the gross or net earnings.

(3) To control the issue of stock and bonds. Some commissions desire to limit total capitalization to the actual cash investment; others to the actual or estimated net earnings capitalized. This purpose of valuation would be equitable and satisfactory if used in connection with a fair rate of return on the investment, gauged by the original and subsequent risks of capital, and providing that the appraisal includes all costs of organization, construction and development of the property.

(4) To determine the basis of valuation for rate making. This furnishes only one feature necessary for equitable rate making; the principal basis for rate making is adequate compensation of value of service rendered.

(5) To determine a basis for the sale and purchase of property, or for future government ownership. This should involve principally a determination of net earnings and estimated future earnings, also the rate of capitalization.

(6) To ascertain a basis for rentals on joint operation. This involves the cost of reproduction and the economics of non-competition or duplication, and is not based on net earnings.

The purpose of the valuation has a direct bearing on the method to be used in the eyes of the commissions and of the corporations, as may be noted by their usually diametrically opposite views. It is therefore advisable to carefully consider what bearing the method of valuation has upon the purpose to be accomplished.

For instance, it would be materially unfair for a company to desire to include a value for its franchise for the purpose of tariff rate making and yet endeavor to exclude franchise value for purposes of taxation.

Nor would it be reasonable for a commission to arrive at any considerable franchise value for purposes of taxation (by capitalizing the net earnings at a low percentage rate) and then limit the issue of securities to what may be estimated by physical appraisal.

It should be noted that if the rate of the investment is first settled, on a basis commensurate with the original and subsequent investment risks, this determination will eliminate largely the contention between the differing interests.

The earnings of a property can not be taken as a basis of valuation for rate making, as the earnings are directly dependent upon the rates and tariffs charged, also upon the economic conditions of location, construction, development and efficiency of management.

The question of valuation should be considered from the viewpoint of determining a reasonable rate of return, on the cost of organization, construction and development, after deducting operating expenses, depreciation and taxes.

RATE OF RETURN.

Volumes have been written on the methods, theory and practice of valuations and appraisals of public utility properties without meeting the solution of the one vital question that should first be determined, i. e., what is a fair rate of return, before any practical value can accrue from valuations and appraisals. In the writer's opinion altogether too much stress has been laid on the importance of the physical valuation as being a fair value of any property.

The courts have held that in addition to the value of the physical property there is a non-physical value to be added in order to reach a fair value of the property.

The difficulty found in most methods and theories on valuations that have come under the writer's notice and investigation is in the practical application of any scheme or basis of valuation, also by omitting the analysis and study necessary to arrive at what is to be considered and accepted as a fair rate of return on the investment, and until that one question is fairly met and agreed upon, there can be no right solution of the several other matters that seem to have been almost solely engaging the mind and attention of the public, government commissions, legislatures and corporations.

The courts have held that the public service corporations are entitled to earn:

(a) Operating expenses.

(b) Expenses of repairs and maintenance.

(c) Taxes.

(d) Sinking fund to cover obsolescence and depreciation.

(e) A reasonable profit on the fair value of the property, from which it will be seen that the whole question rests on:

(1) What is a fair rate of return on the investment.

(2) What is a fair value of the property.

After the above are determined and an analysis made of the service necessary and operating details, maintenance of the property, taxes and sinking fund, it can then be determined what the proper tariffs should be to insure a reasonable rate of return on a fair value of the property.

Satisfactory results and regulation cannot be secured until the first ques-

tion is determined, and the writer will hazard, as a suggestion, a basis for determining the fair rate of return, believing that if the subject is judiciously considered, it may be found acceptable to public utility properties and also to investors and the public.

A practical method of determining what is a fair rate of return on the investment may be had by considering on what basis and on what terms can funds be obtained for the construction and equipment of a new property and for extensions.

The investor in a new property always considers it somewhat of a risk, even though he has faith in the final result, but his experience in the past has shown him that he would not be warranted in making an investment unless the examination and report, prepared by competent authorities, indicated that the probable net earnings above operating expenses, maintenance and taxes, are approximately equal to perhaps twice the total fixed charges, *i. e.*, interest on the bonds issued to produce the property. The investor would not be satisfied to go into a new property if the return on his investment was to be limited to six per cent, unless that amount were guaranteed, for experience shows that he takes a decided risk and may not receive even the rate obtainable by investment in "seasoned" or proved securities, therefore, he feels justly entitled to participate in any expected surplus earnings made above the fixed charges. This has been usually accomplished by issuing common shares as a bonus; the promoter, who has generally spent much time—perhaps years—as well as money to bring about the establishment of the enterprise, also feels that he is justly entitled to share in any possible surplus through ownership of a portion of the common shares. Now, if the public is fully informed that the common shares do not represent cash investment, or only partially so, no harm or wrong can accrue.

On the above basis, considering that the capital cannot be obtained unless the estimated earnings equal approximately twice the fixed charges, it is fair to assume that the investor taking a risk attached to any new undertaking should be permitted to receive in addition to a return of interest on the bonds, a similar return on an equal amount of common shares after which, by proper regulation of rates, or perhaps by imposing a heavy tax on earnings above the amount agreed as a reasonable rate of return on the investment, the surplus earnings could be reasonably well regulated.

On the other hand, should the property not earn its fixed charges, as too frequently has been the case, the investor would sustain a large loss. The property, however, must continue to operate and serve the public and at the expense of the original investor. This requirement and obligation of the original investor is generally disregarded by the public, but it is an important factor and consideration by which, due to there being no minimum guarantee of return on the investment, he is reasonably entitled to a return up to the estimated rate on faith of which he undertook the investment.

Merely as suggestions and without attempting to say that they should be adopted, the writer gives the following tentative percentages as a fair rate of return on invested capital that would not seem unreasonable under the conditions named:

(1) Five per cent where the interest and principal are guaranteed by the government.

(2) Six per cent on extensions of large properties showing substantial earnings.

(3) Seven per cent on extensions of large properties showing small surplus earnings.

(4) Eight per cent on extensions of small properties showing substantial surplus earnings.

(5) Nine per cent on extensions of small properties showing small surplus earnings.

(6) Ten per cent on new properties where the estimated net earnings for the first year of operation under accepted methods are from eight per cent to ten per cent on the total cost of organization, construction and development.

(7) Twelve per cent on new properties where the estimated net earnings under accepted methods would not pay five per cent on the cost of organization, construction and development during the first three years, but where ultimately it is estimated that the property would earn good dividends.

(8) A variable percentage on existing properties.

(1) Five per cent where the interest and principal are guaranteed by the government, is not now applicable to this country, although it was found necessary for the government to guarantee the bonds in order to secure the construction of certain new steam railroads in the Philippine Islands; and it is common practice in Canada, where frequently a cash subsidy is given in addition. In South America the government guarantee is customary even at higher rates of interest than those indicated and, in this connection, it should be noted that under the existing sentiment now prevalent in this country in respect to the relations between the public, the government and the public-service corporations today, investment capital is going largely into South America and Canada in preference to the United States. This condition should and can be changed by a reasonable and prompt settlement of the differences between the corporations, the public and the government.

(2) Six per cent on extensions of large properties showing substantial surplus earnings, is based on probably the most favorable conditions existing in this country, and unless six per cent is certain to be realized from additional investment, neither the corporation nor the investor would be warranted in making the extensions or improvements. The limitation of the originally invested capital to a six-per-cent return would not be justified, for it has during its development period carried large risks.

(3) Seven per cent on extensions of large properties showing small surplus earnings, which condition would usually be found in cases where the additional investment would strengthen the position of the property and add a considerable amount to the surplus earnings, seems a reasonable rate, for it is certain capital under such conditions would require prospects of at least seven per cent in return, as the risk is somewhat greater than in the preceding case.

(4) Eight per cent on extensions of small properties showing substantial surplus earnings, being that of a smaller corporation and without the benefit of more extensive credit and resources, necessarily carries with it a higher rate of return to the investor, and eight per cent does not seem an unreasonable basis of expected earnings.

(To be continued.)

WISCONSIN ELECTRICAL ASSOCIATION.

SECOND ANNUAL CONVENTION AT MILWAUKEE, WIS., JANUARY 18 AND 19.

The second annual convention of the Wisconsin Electrical Association was held in Milwaukee, Wis., January 18 and 19 at the Hotel Pfister. It will be remembered that this Association was formed by the consolidation of the old Northwestern Electric Association and the Wisconsin Electric and Interurban Railway Association two years ago, and the renewed interest taken by the older members as well as the constantly increasing membership is indicative of the wisdom of the amalgamation.

It is unfortunate that Pres. Clement C. Smith was unable to be present at the meetings, due to illness, as was also the case at the summer meeting held last June at Oshkosh. His work, however, was apparent on every side, as complete arrangements for the convention had been made by him before it was apparent that it would be unable for him to attend.

George B. Wheeler, of Eau Claire, first vice-president, called the meeting to order at 10 a. m., Wednesday, and after lamenting the illness of President Smith and paying a glowing tribute to his work during the past year, called for the report of the secretary-treasurer, which was then presented by Secretary J. S. Allen, of Lake Geneva.

This report covered the business accomplished by the Association during the year, including the result of the membership campaign carried on. The financial statement showed a balance on hand of $1,000.

The president then appointed a committee of three to audit this report, the committee being composed of L. E. Jackson, A. D. Alt, H. C. Sterling.

The first paper to be presented was entitled "Publicity Campaigns," by Ernest Gonzenbach, president Sheboygan Railway & Electric Company. As a preface to his remarks, Mr. Gonzenbach, who is an ex-president of the Association, spoke of the inactivity of ex-presidents after their term of office and urged that the retiring officers keep up their interest and work in the Association.

PUBLICITY CAMPAIGNS.

This paper opens with a review of political conditions as they exist today and as they affect public utility companies. In the desire to deal directly with the consumer, central stations recognize the principle that their business is founded on the maintenance of mutual good-will, and their object is to develop this good-will of their ultimate consumers. Without this mutual understanding and the feeling of good-will on both sides, it would not be worth while to stay in business. There is also the greater task—getting in contact with that portion of the public which never does make complaints and whom you never see. How are you going to reach them. There is one way of borrowing a leaf from the book of that class of business which has things to sell to people whom it never sees. Advertise. But advertising does not necessarily mean buying a lot of space in newspapers and filling it up with whatever happens to be handy. Advertising in your own street cars, if you are in that business, is one of the very best methods, and it will pay any company to reserve for its own use the very best space in the car to make such public announcements as it, from time to time, wishes to convey to the public. The end of the car has been found to be the most valuable space. Billboard advertising has been found quite successful by some companies. A plan which has recently been developed, and which has been found to be of advantage in a good many cases, is that of issuing a regular weekly or monthly publication; this is frankly published by and for the interests of the public utility company. But the publication of such a publication requires more literary ability than the average small company is able to produce on short notice. To make it successful, it must be exceedingly readable, being well-written, pungent and very much to the point. The company which cannot produce its own copy and have it interesting and full of local color, had best depend on newspaper advertising as the simplest and surest method of accomplishing its purpose and, perhaps, a still safer plan would be to have some firm of publicity experts write the copy for their advertising. Like the passengers on our cars, each and every one of whom thinks that he is infallible to accident, and that he, last of all, will meet with any trouble, we seem to think that our own copy is unsurpassed. We do not realize how utterly foolish some of our own writing looks to people who are forced to read it and have no interest in us.

W. H. Winslow, of Superior, opened the discussion. He said that attention directed to a public service company may or may not be a good thing. At times when there is an apparent cessation from public or political attack a publicity campaign will direct attention towards the company and tend to renew unpleasant relations. Mr. Winslow also referred to the misrepresentation to which public utility companies are subject and said that especially as regards the publishing of financial statements are wrong interpretations liable to be made.

Glenn Marston, of Chicago, said that the first essential in securing public good will is absolute frankness. A campaign based on evasions or half-truths cannot succeed. A company should always have its house in order, so that it can immediately answer any attacks with a full and true statement of actual facts. He emphasized the point that newspaper advertising should be for profit, and every line should pay its own way, and this applies to so-called policy advertising as well as to commercial advertising. The return from policy advertising will not be as direct or immediate as will the return from strict commercial advertising, but it should be prepared with the idea of familiarizing the public with the business, so that prospective purchasers will meet on some common ground. He said that the people have not been shown what a great factor in civic development electricity is.

TUESDAY AFTERNOON SESSION.

At the opening of the afternoon session T. F. Grover, of Terre Haute, who is a former member of the Northwestern Electric Association, expressed his gratification at the work being done by the Wisconsin association, as evidenced by the convention program. Telegrams of congratulation were also read from Messrs. Almert, Jackson, Gille and Harding, also former members.

One of the most interesting and at the same time important features of the convention was the address by Edwin S. Mack, of the law firm of Miller, Mack & Fairchild, on the subject of "Some Principles Established by the Decisions of the Wisconsin Railroad Commission." Mr. Mack's address covered rate making, valuation and other important points covered by the decisions of the Commission and was a most comprehensive analysis of the subject.

SOME PRINCIPLES ESTABLISHED BY WISCONSIN RAILROAD COMMISSION.

In opening Mr. Mack spoke of the work of the Railroad Commission during the five and one-half years of its active work as a public service commission. During the past three and one-half years the commission has had active control over electric utility companies and in this time has considered such phases of the work as standards for service, railroad refund cases, service and rate complaints, application for rate increases and reviews of regulatory city ordinances. The Commission has issued five volumes of decisions covering these points and of the total number of cases coming under its jurisdiction one-half have been settled informally.

In all of its decisions, Mr. Mack said that the Commission has in most cases dealt with questions of service in favor of the public. If higher rates have been found to be necessary for better service, these have generally been allowed by the Commission. In all cases the Commission demands that good service be rendered.

As regards decisions on rates the method of the Commission is to determine whether or not the Company is making more than a reasonable return on its investment, and

how it computes its investment. The Commission investigates the gross earnings and operating expenses. A deduction is made for depreciation and then the question of the reasonableness of the return is determined. This involves what is the correct principal on which to compute the return and what percentage for interest and profit shall be allowed. Then the distribution of profit over rates, the division of gross earnings and the rates for each class of service are determined. The decision involves what is a basis for return, on what basis shall allowance be made for depreciation, what percentage of the rate of return shall be allowed and how shall this be divided for the different classes of service.

In determining rates the Commission leaves aside the amount of outstanding securities and reduces the investment to a cash basis or on the valuation of the plant. In determining valuation three things are considered: (1) original cost, including additions and extensions; (2) cost of reproduction new, and (3) present value with each item subject to a reduction due to wear and tear.

The actual investment is the proper basis on which to determine rates but the Commission has recognized two qualifications which are (1) that the expenditures must not be so prudent as compared with the present value of the investment as to make the return thereon result in a rate unusual or higher than the value of the service to the customer; and (2) the investment must have been made under normal conditions and with ordinary business sagacity.

Mr. Mack said that the Commission in computing the investment considers the source of funds to be immaterial, mattering not whether they are surplus, new capital, or gifts. The total investment includes going value which the Commission considers compensation for losses in establishing the business to a going basis. This value is computed as follows: Aggregate operating expenses plus depreciation, plus interest, minus gross earnings, plus interest, the annual balances thus obtained. The commission has allowed six and seven per cent as proper rates of interest in computing cost of going value, the lower rate being applied where the service is inferior.

The Commission has laid down certain qualifications so as to limit the normal cases the recognition of cost of going value on this basis. So the cost of going value will be subject to modification or possible disallowance: (1) If the plant is built ahead of public needs. (2) If there are no present prospects of profit, as in a case where the development of a community has been arrested. (3) If there has been unwise construction, blunders, etc. (4) If part of the plant is not needed or if there have been excessive values in land. (5) If there has been incompetent management.

The result of this is, according to Mr. Mack, that the greater responsibility is thus placed upon public utility companies than is exacted from private corporations, and this is an additional element of risk which should be considered. On this doctrine public utility companies cannot retrieve errors as private business can, where mistakes are expected to be compensated. The commission has gone so far as to apply this theory of going value to a municipal purchase. Ordinarily going value is taken as estimated value of established business and not cost of establishing it.

The valuation for reproduction new is usually twelve per cent and applies to all but stores, supplies and paving. This is divided into five per cent for engineering, four per cent for interest on construction and three per cent for legal expenses, omissions and contingencies.

The Commission has departed from a strict valuation by the methods usually adopted, and has placed restrictions which are explicable only on the theory that the Commission's reproduction cost is not a real valuation, but a check on or approximation of the cost. Good will the Commission has refused to recognize, maintaining that it does not exist in the case of the public utility corporation. Franchises have been recognized as having value, but have not been considered as an element of the valuation for rate purposes.

The Commission has distinguished between interest and profit. It has regarded a certain percentage of interest as a part of the cost. The percentage frequently used is eight per cent, chiefly for electric industries, but in cases of water companies, seven per cent has been used. In cases of municipal plants the Commission has taken four per cent.

Senator George B. Hudnall, of the Wisconsin Legislature, who was chairman of the committee which recommended the establishing of the Railroad Commission, said that the excellent results being accomplished was due to the fine personnel of the Commission. He thanked the representatives of the public utility companies present for the co-operation extended when the legislative committee was collecting data previous to submitting its report on the advisability of establishing a Commission.

A vote of thanks was then extended Mr. Mack for his valuable address.

The next order of business was the presentation of a new constitution and set of by-laws for adoption. These were read by Irving P. Lord, of the Executive Committee, and were unanimously adopted with one amendment, which definitely names the place for the annual meeting as Milwaukee, and sets the time for the second or third Wednesday in January.

Various business was then taken up, including the appointment of a nominating committee, composed of Ernest Gonzenbach, chairman, P. Valier and B. J. Broad. A report was then made by the Committee on Affiliation with the National Electric Light Association, which was appointed to report as to the advisability of affiliating. The committee, which was composed of P. H. Korst, W. R. Putman and L. L. Tessier, advised that, due to the differences in membership requirements, it was not advisable to affiliate with the National Electric Light Association, but recommended co-operation between the Associations and individual members.

THURSDAY MORNING SESSION.

A paper by A. J. Goedjen, superintendent of tests for the Milwaukee Electric Railway & Light Company, entitled "Electric Meter Testing," was presented at the opening of the morning session on Thursday.

ELECTRIC METER TESTING.

In these days, whenever a commodity is sold, instruments are used to determine its magnitude. It may be measured, weighed or metered, depending upon its nature. In the case of electricity, the commodity is almost universally measured by an electric wattmeter of some kind. The electric meter, although at first rather a crude and none too accurate device, has greatly facilitated the measuring and sale of electricity and has thus helped a great deal in making electricity a commercial proposition. At present it has been improved wonderfully, and with proper care and calibration, can be relied upon to record electrical energy very accurately. Central-station manangers often give the customer's meter too little attention, apparently believing that it will retain its calibration as well as a yard stick or a quart measure. In fact, the watt-hour-meter has been given so little attention by electrical men that it is generally not well understood, even by authorities. Let us assume a meter calibration of two per cent slow on full load, three per cent slow on half load, and seven per cent slow on light load as an average case on a system which ignores its meters to some extent. This is very fair if many old type meters are being used. It is also fair to assume that in this case the total energy is metered at an average of four per cent slow, or in other words, only ninety-six per cent of the energy delivered is actually recorded. It means that the total income of the plant is but ninety-six per cent of what it should be. The real importance of correct registration on low loads is not generally realized. The average meter is operating a very considerable proportion of the time on ten per cent or twenty per cent of full load. This is becoming more important because of the introduction of the tungsten lamp making a light load on a meter, often as low as a quarter of an ampere or only five per cent of the rating of a five-ampere meter. Most new meters are in accurate adjustment when received from the factory, but it is well to check them in the laboratory and advise the manufacturer if any of them are not O. K. Of course, old meters which have been repaired or stored should be given a laboratory test to make sure of their accuracy, before being taken out and installed. After installation the meter receives its regular routine test in regular order with the other meters on the system. In the state of Wisconsin, the commission fixes the test period at one year, and this is a very fair average. It is true, however, that an alternating-current induction meter will retain its calibration as well for eighteen months as any average direct-current commutator meter will for six months. In the case of large direct-current meters measuring a large amount of power, the calibration might well be checked up quarterly, and, in large alternating-current induction motors, the calibration should be checked up every six months. Besides keeping the meter in better adjustment and thus increasing the company's revenue, frequent testing should result in good in various ways.

The discussion was opened by J. N. Cadby, of the Wisconsin Railroad Commission, who said that the matter of meter testing is being much more appreciated since the rulings of the Railroad Commission have gone into effect. Regarding testing of meters Mr. Cadby said that all meters should be classified by a central station, according to its

age, revolutions, etc., and should be tested accordingly. In this way meters that need testing will be given proper attention and an appreciable saving will be effected by the elimination of unnecessary testing. Mr. Cadby said that the only basis on which to get central stations to test meters is on the income basis.

In reply to a question by George B. Wheeler as to the number of meters a man can test in one day, Mr. Cadby stated that it depends entirely on the type of meter and upon its location, both on the premises and with respect to the distance between the meters to be tested. He expressed an opinion that from six to ten per day was the average number. Mr. Cadby added that meters should be tested after installation, as they are subject to carelessness during shipment to a customer's premises and also to the carelessness of the installer.

In reply to a question as to the stand the Commission has taken regarding the electrolytic type meter, Mr. Cadby said that the Commission as yet has only specified the conditions under which these meters will be approved. They are ampere-hour instead of watt-hour meters and they should not be installed where there is a very great overload.

P. H. Korst asked that where a meter is found with weakening magnets, can it be assumed that the magnets will remain in the condition in which they are found or will they continue to weaken? Mr. Goedjen replied to this question, stating that the practice of the Milwaukee Company was to renew the magnets, assuming that they would continue to weaken.

Prof. C. M. Jansky, of the University of Wisconsin, spoke on this subject, stating that it depended upon whether the weakening was caused by short circuit or was due to long usage. He said that the most important point in meters is the torque-weight ratio. Professor Jansky referred to the importance of the accuracy of the standards used in testing meters. He urged that every central-station company should maintain a good set of standards and explained that the Bureau of Standards at Washington, D. C., or the Electrical Testing Laboratories at New York will test a company's standards for a nominal fee. Referring to a statement made by Mr. Goedjen that laboratory tests of alternating-current meters should include a test at full load amperes at unity power factor; full load amperes at fifty per cent power factor and a test at ten per cent of full load at unity power factor, Professor Jansky explained a method of determining the power factor, using only an ammeter for three-phase circuits, instead of a voltmeter, ammeter and wattmeter.

David McNaughton, of the Milwaukee Electric Railway & Light Company, took up the subject of reading meters and explained the system of reading employed in Milwaukee. The marking system is used and Mr. McNaughton said it had the advantages of allowing readers with very little experience being employed; it eliminates delay in reading meters and is the means of providing records which can always be referred to. The principal disadvantage is that one can misplace the position of the dial hands.

H. G. D. Nutting, of Ft. Atkinson, explained the system of reading meters employed in Ft. Atkinson. The marking system is used and duplicate blanks are made out, one of which the customer keeps. The amount of the bill is calculated on the original blank and is placed in a record book until paid. In this manner no dispute as to whether or not a bill has been paid can arise, as the original can be produced at any time until payment has been made, when it is given to the customer as a receipt.

A paper entitled "Electricity as an Advertising Medium" was next presented by C. M. Axford, of the General Electric Company, Chicago. This paper dealt with ornamental street lighting, electric signs, decorative street lighting and other methods of extending the use of electricity in this direction. Mr. Axford dealt with the subject of ornamental street lighting, not only from the standpoint of the central station, but also from the standpoint of the merchant and the public official, and with the question of the extent to which the central station should encourage this form of business. A fuller abstract of this paper will appear in a later issue.

W. H. Winslow, of Superior, opened the discussion by citing his experiences in ornamental street lighting. He mentioned a recent installation in Superior comprising heavy, plain standards each equipped with three 100-watt lamps. The property owners own and maintain the two lower lamps, which burn from dusk to midnight. The top lamp burns until daybreak and the current is paid for by the city. In reply to a question as to whether the contracts are made with the property owners or the tenants, Mr. Winslow said that contracts covering a period of one year are made with the tenants. He explained how the local Commercial Club takes an interest in the installation and how it assisted in gaining customers.

G. C. Ewing, of Wausau, described an installation recently completed in Wausau. The city owns all of the equipment and buys current from the local central-station company for 2.25 cents per kilowatt-hour delivered to the transformers.

C. N. Duffy, of Milwaukee, referred to the installation of ornamental lighting on Wisconsin Street and Grand Avenue, Milwaukee.

The report of the Nominating Committee was then presented by Chairman Gonzenbach. The following slate was then presented and the candidates unanimously elected: President, George B. Wheeler, secretary and general manager, Chippewa Valley Railway, Light & Power Company, Eau Claire; first vice-president, Irving P. Lord, president and general manager, Waupaca Electric Light & Railway Company, Waupaca; second vice-president, W. H. Winslow, secretary and general manager, Superior Water, Light & Power Company, Superior; third vice-president, Roger N. Kimball, general manager, Kenosha Gas & Electric Company, Kenosha; and secretary-treasurer, George Allison, comptroller, Eastern Wisconsin Railway & Light Company.

THURSDAY AFTERNOON SESSION.

At the opening of the afternoon session on Thursday, W. J. Kelsh, master mechanic, Wisconsin Electric Railway Company, read a paper entitled "Electric Railway Repair-Shop Practice."

ELECTRIC RAILWAY REPAIR SHOP PRACTICE.

This paper dealt with a number of interesting problems in connection with the maintenance of street railway rolling stock. The equipment over which Mr. Kelsh has charge comprises ten double-truck interurban cars, five double-truck city cars, twenty-three single-truck closed city cars, seventeen open trailers, six single-bench ten-bench open cars, four double-truck, fifteen-bench Narragansetts, two sweepers and one snow plow. The paper then considers the cost of operating and maintaining this equipment, describing in detail the shop system and the cost of painting and repairing the cars. The inspection system employed is also fully explained. The Company has in the past two years painted nine interur-

ban cars and fourteen city cars, from the bare wood, at an average cost of $137.38 for interurban cars and $83.55 for city cars.

Following this, C. N. Duffy, comptroller of the Milwaukee Electric Railway & Light Company, delivered an excellent address on the subject of "Insurance," treating particularly the question of such improvements that may be made to properties of electric utility companies with a view to reducing the insurance.

INSURANCE.

Mr. Duffy's address was based on his experience with the Milwaukee company and his efforts in having the insurance rates materially reduced. He opened his remarks by reading extracts from a bulletin of the National Electric Light Association under data of December 10, 1910, in which it was urged that lighting companies unite in demanding lower insurance rates. The insurable property of the Milwaukee Electric Railway & Light Company, in the City of Milwaukee, amounts to practically $6,000,000 and of this amount insurance is carried on only $3,000,000 of property. Mr. Duffy said that if it were not for the cars it is possible that no insurance would be carried on the car houses. In 1908 the Milwaukee Company took up the matter of reduced rates with the insurance companies, threatening to carry its own insurance unless lower rates were granted. The insurance companies were willing to allow lower rates if the company would comply with certain specified conditions. These conditions, which applied to the property as a whole required that fire drills should be conducted in building in which over five men were employed; oil waste should be kept in approved metal cans; trolley must be kept off trolley wire when cars are in barns; paints and varnishes to be kept outside of the buildings; fires not to be built in stoves when cars are in the barns; and that metal lockers should be substituted for wooden lockers. Mr. Duffy then itemized the various changes and additions to the various buildings made necessary before a reduced rate would be granted. The changes cost the Company $15,234.94 and resulted in the insurance rate being reduced from $28,000 a year to $20,000 a year, so that the improvements were soon paid for, in addition to adding to the value of the property. Mr. Duffy was certain that if other public utility companies would take up this matter of fire insurance with the underwriters it would result advantageously to them. The interests of the companies and the fire insurance companies are mutual, and the latter would be glad to co-operate. Mr. Duffy then spoke of fire insurance reserve. He thought every company should have such a reserve as no fire loss adjustment covers entirely the actual loss.

A. K. Ellis, of Appleton, explained how the company he represents was able to obtain a reduction in its rate of thirty-four cents per hundred by adopting a plan of action similar to that outlined by Mr. Duffy. The Company was formerly paying $1.84 per hundred.

R. N. Kimball cited an instance where, after a fire, owing to the form of policy held by the lighting company, parts of the equipment were found to be under-insured and parts over-insured. The total adjustment was made with a large loss to the plant.

Mr. Douglas, of the Milwaukee Company, called the attention of the Association to a number of inconsistent rulings made by the Board of Fire Underwriters. He cited some unusual instances where equal rates have been given, such as two stores in the same building, one being equipped for electric lighting and one for gasoline lighting, etc.

At this point John I. Beggs, president and general manager of the Milwaukee Electric Railway & Light Company, entered the meeting and read a telegram of congratulations from President Brady of the American Electric Railway Association.

Mr. Beggs then extended congratulations to the Association in behalf of

GEORGE B. WHEELER,
President, Wisconsin Electrical Association.

the Milwaukee properties. He added that it was never so necessary for associations and companies to stand shoulder to shoulder as it is today. He said that the trouble of one should be made the trouble of all. Referring to the benefits to be obtained by belonging to such an Association as the Wisconsin, Mr. Beggs said that the smaller companies needed the help a great deal more than the larger companies, who were generally in a position to employ experts for the numerous branches of the work, while smaller companies sometimes had to rely upon one man to look after the entire affairs of the company. Mr. Beggs spoke of the work of the Wisconsin Railroad Commission and said that the public utility companies of the state had received reasonably fair treatment so far. It is generally the fault of the company when it is dealt with harshly. He said that regulation has come to stay and it is the duty of the companies to make it reasonable. The agitation for lower rates is due, according to Mr. Beggs, to the companies who have established rates so low that it is impossible for them to maintain their property as it should be maintained.

BANQUET.

On Wednesday evening the Association banquet was held in the Red Room of the Hotel Pfister. A brilliant array of speakers were arranged for and the affair was a most enjoyable function.

The principal speaker was Prof. Shailer Matthews, dean of Theology, University of Chicago. Professor Matthews chose for his subject the "Human Element in Business" and he delivered an eloquent and interesting address. Other speakers were: Frank G. Bolles, of the Alliance Engineering & Sales Company, Milwaukee; C. M. Axford of the General Electric Company, Chicago; Irving P. Lord, of Waupaca; Professor Breckenridge, of Yale University, and Oliver C. Fuller, of Milwaukee.

EXHIBITS.

The following companies maintained headquarters in the various parlors of the hotel: Julius Andrae & Sons Company, Allis-Chalmers Company; Central Electric Company; Federal Sign System (Electric); Ft. Wayne Electric Works; General Electric Company; Simplex Electric Heating Company; and the Westinghouse Electric & Manufacturing Company.

The following representatives were in attendance:

Morgan P. Ellis and E. B. Gray, Holophane Company, Chicago; M. L. Deming, J. D. A. Cross, C. M. Axford, George C. Osborne, T. W. Jackson, J. M. Van Splunter and S. F. Dibble, General Electric Company, Chicago; A. L. Pond, W. B. Crabtree, L. M. Sage and H. L. Eicker, Fort Wayne Electric Works, Fort Wayne, Ind.; L. W. Burch, Electric Supply Company, Madison, Wis.; A. C. Keene and O. O. Tucker, Western Electric Company, Madison, Wis.; Fred Benson, N. Gray and Curtis C. Curry, Westinghouse Electric & Manufacturing Company; E. A. Lambrecht and C. A. Cummings, Federal Sign System, Chicago; Frank E. Johnson and R. J. Deneen, Ohio Brass Company; W. F. Ruby, Simplex Electric Company, Chicago; J. B. McMullen, Electric Appliance Company; A. W. Bryant, Sangamo Electric Company, Springfield, Ill.; C. A. Felker, B. J. Kacin, A. B. Dunham and Thomas C. Ringgold, Central Electric Company; Louis Rembard, Mechanical Appliance Company, Milwaukee, Wis.; H. E. Thomas, Acker Electrical Company, Sheboygan, Wis.; E. P. Smith, E. P. Smith Electric Company, Dubuque, Iowa; E. S. Stewart, Standard Underground Cable Company, Chicago; J. M. Stewart, Willis Electric Meter Company, and C. C. Ewing, Electric Service Supplies Company, Chicago.

Exception Taken to Statement Regarding Lack of Foresight in Design of Incandescent Lamps.

To the Editor:

Between a fifth and a sixth of the able article on "The Lighting Situation" by Dr. Louis Bell, in your issue of January 7, is devoted to a lament over an alleged lack of intelligent standardization of tungsten-filament lamp bulbs, which lack is asserted to be enough to cause the illuminating engineering profession to part company with the water wagon.

The writer wishes to take exception to certain statements by Dr. Bell, quoted below, and believes that all those who realize how much attention has been, and is being given by the lamp manufacturers to the problems of bulb standardization will also feel like taking exception thereto. Quoting from the article in question, "It may be remarked that the tungsten lamps suffer from lack of intelligent standardization with respect to size and shape of bulb." The author goes on to call attention to the fact that the bulbs of tungsten-filament lamps of a given capacity vary between maker and maker, and as compared with the corresponding sizes of carbon lamps, just enough to make the shades which fit one incapable of fitting the other, and he adds that this difficulty "is made all the more exasperating on account of the tendency toward making the three smallest sizes of tungsten lamps all with bulbs of the same size." Continuing, the author says that a certain type of glassware gives an admirable effect when used with one 25-watt tungsten-filament lamp, but when used with another type of which the bulb shape and frosting line are slightly different, fails to screen it satisfactorily. Quoting again, "the thoughtless observer might fancy that he detected here a shrewd trade trick, but . . . the identity of the articles would . . . make it perfectly clear that the trouble was simply due to lack of foresight on the part of somebody. Incidentally, it is quite impossible to fathom the reason for making the ordinary 25-watt tungsten lamp just enough bigger than the old standard 16-candlepower lamp, so that the closed globes which fitted the latter will not fit the former. . . . Things of this sort will undoubtedly be remedied in a few years but with the long experience that has been had in the incandescent-lamp industry already they should have never occurred at all."

Rather than dwell on the stretch of imagination required to suppose that the lamp experts of this country would nonchalantly standardize bulb sizes without heed to the commercial consequences of such standardization it will be more to the point to give specifically the principal reasons for the discrepancies which Dr. Bell finds.

(1) In regard to tungsten-filament lamp bulbs of the same wattage varying in size *inter se*. Each size of lamp developed has, as soon as the commercial demand for it becomes evident, been standardized, by mutual agreement among the principal lamp manufacturers, as to its diameter and over-all length. About sixteen months ago the manufacturers went even further than this. A bulb committee composed of delegates of the leading lamp companies and glass manufacturers undertook the enormous job of standardizing all the dimensions of the flat templets which are used by the glass factories in checking molds and bulbs, as well as by the lamp makers in checking the product of the glass factories, so that these templets would not only be of the same diameter and length, but would be punched from dies made from blue-prints of standard working drawings, all the radii of curvature of the various bulbs, with the location of centers, being worked out to the minutest detail. At the same time, the entire system of bulb nomenclature has been simplified and improved.

Incidentally, the widespread co-operative movement among American manufacturers, such as the member companies of the National Electric Lamp Association, the General Electric Company, the Westinghouse Lamp Company, the Franklin Electric Manufacturing Company, and others, to standardize bulb shapes, is without a parallel in European practice, either in Great Britain or on the Continent. Foreign metal-filament lamps of equal nominal wattage are found to vary enormously as to their dimensions, when judged by American standards. In extreme cases the light centers vary as much as one inch from each other, so that reflectors intended to give an extensive distribution of light give a focusing distribution, and *vice versa*.

To return to the admittedly slight discrepancies which Dr. Bell found between his 25-watt tungsten-filament lamps, these might be explained in two ways. First, it is possible that one or both of the lamps in question were not the product of any of the manufacturers who have a common agreement as to the dimensions of their bulbs, although this agreement would certainly cover over ninety per cent of the lamps manufactured in this country. Another possibility is that one of the lamps was a four-filament ("four-loop") lamp and the other a five-filament lamp, as at least one of the companies included in the above-mentioned agreement makes its 25-watt lamps with five filaments, in a shorter bulb. The reasons why most of the companies have not found it advisable to follow the practice of this one, but prefer to make their lamps with four filaments, will be discussed later.

(2) Regarding what Dr. Bell says about the tendency "toward making the three smallest sizes of tungsten lamps all with bulbs of the same size" (meaning undoubtedly the 16, 20 and 25-watt 100-125-volt multiple types) it may be pointed out that the 16 and 20-watt tungsten-filament lamps are not yet standardized, and in fact may be regarded as still in the experimental or tentative stage, and while in this stage it would be only natural that they should be made in the smallest bulb of the types already standardized (*i. e.*, the 25-watt).

For several months, however, the 16 and 20-watt sizes have been made in the "S-18" bulb which is one-eighth inch smaller in diameter than the 25-watt or "S-19-B" bulb. Moreover, the 16 and 20-watt tungsten-filament lamps are both smaller in diameter (2.25 inches as against 2.375 inches) and shorter (4.75 inches over-all as against 5.0 inches) than the 50 and 60-watt carbon lamps, which are made in the same bulb as the former "standard 16-candlepower lamp."

The chief complaint that Dr. Bell makes is that tungsten and carbon lamps (I infer that he means of the same approximate candlepower rating), differ from each other in their dimensions in such a way that globes which fit the carbon lamps cannot be used for the tungsten. This, by the way, does not hold in the larger sizes, since the tungsten-filament 40-watt

lamp bulb is actually three-eighths inch smaller in diameter than the 100-watt carbon—both of these lamps giving approximately 32-candlepower—so that it would be perfectly possible to substitute a 40-watt tungsten-filament lamp for one of the old style 32-candlepower carbons, without changing the globe. Coming to the smaller sizes, it is true that the pear-shaped 25-watt tungsten is one-fourth inch longer (5.25 as against 5.0 inches) than the 50-watt or 60-watt carbon lamp, although the round bulb 25-watt tungsten (only 4.375 inches long) can be used to replace the pear-shaped carbon lamp in practically any closed globe. As the pear-shaped 25-watt tungsten and the pear-shaped 60-watt-carbon-lamp bulbs are of the same diameter, it is evident that Dr. Bell must refer to the quarter-of-an-inch difference in length just mentioned when he says that the cause for the bigness of the tungsten bulb is "impossible to fathom." The real reason is that it is impossible to build a long-filament 25-watt tungsten lamp much, if any, shorter than that now used, without seriously impairing the performance of the lamp owing to the proximity of the filament to the glass, if not indeed causing actual physical interference. Why, then, it may be asked, are the filaments of some 25-watt Mazda lamps longer than those of others? The 25-watt lamps with the longest filaments are the four-filament lamps, as distinguished from the five-filament. It is claimed by those manufacturers who make the four-filament lamps that a greater number of joints and filaments increases materially the liability to breakage and to interlocking of the loops and they, therefore, feel that they are justified in using four filaments, even though a longer bulb is required. Then, too, a bulb must be designed for the highest-voltage filament which may be put into it. For instance, a 125-volt lamp requires a considerably longer filament and center rod than the 105-volt lamp. It would be folly for the manufacturers to use several sizes of bulb for lamps of the same capacity, simply to fit ancient glassware which, in all save exceptional cases, as for instance where costly decorative shades are employed, is already so obsolete and unsatisfactory from an illuminating standpoint that it ought to be discarded. For each type of lamp one bulb must be standardized, so that all regular lamps of this type will fit all lines of reflectors which have been designed therefor. As an example in point, a certain useful reflector of recent design, for residence-lighting work, comprises an ornamental frosted-glass plate with a circular hole into which the lamp bulb fits snugly. A difference of one-eighth inch in the diameter of the bulbs for which this glassware is designed, or of a quarter inch in their length, would destroy the effect which the reflector makers aimed to produce. Since, as above stated, one, and only one, size of bulb must be standardized for lamps of a given type it follows that this bulb must be long enough to accommodate the longest filament in which that type of lamp is made. (The 40-watt skirted and unskirted tungsten-filament lamps are reckoned as separate types.)

It is not too much to say that the profession of which Dr. Bell is an exponent owes its marked success in America very largely to the intelligent consideration which the lamp manufacturers and their engineers have given to the matter of standardization.

CLEVELAND, O. Roscoe Scott.

Discussion on Corona.

The following discussion of the paper on "Open Atmosphere and Dry Transformer Oil as High-Voltage Insulators," read by Harris J. Ryan at the meeting of the American Institute of Electrical Engineers on January 13, was submitted by J. E. Noeggerath too late to be included in the report last week.

It is interesting to note how the phenomena in vacuum tubes, and also other experiments, bring out certain facts that are related to corona phenomena substantiating particularly the following four points: (1) High voltage required to start the ions (conduction). (2) The continuation of conduction at voltages lower than the starting voltage. (3) The start of conduction at lower voltages if a supply of ions exists. (4) High stress near electrodes and low voltage gradient between them.

The parallel phenomena in mercury-vapor lamps are well known. A lamp can be started by raising the voltage to a very high value; but the current will continue to flow, if once started, at a very much lower voltage. The same was found to be true with laminated brushes on collector-rings running up to speeds of 25,000 feet a minute. It took occasionally more than ten volts to start a current, which in every case continued to flow at a voltage of the magnitude of one volt. There was no visible arc formation when this occurred. Means for comparing the similarity of the conditions in high-tension lines and brush contacts are given in Dr. Whitehead's paper of June, 1910. It shows how the conductivity through ionization continues at lower voltages once it is started. On raising, in brush-contact tests, the current (when new ions have to be produced), the voltage was higher than on lowering the current at the same current density (when a supply of ions already existed).

The condition of a critical striking distance, or thin film with high stress near the electrodes, and a low voltage gradient in the space between, also exists in the mercury-vapor lamp, the fall of potential being much more rapid at the surface of the electrodes than in the space between. On increasing the length of the arc, the voltage required for a given current does not increase proportionately with the length. Similar electrode potentials exist in brush contacts.

The results of the paper point to two requirements in practical work, if higher voltages are to be used. (1) A very big increase in the distance between wires. This means earth return, which can be attained by single-phase transmission, or by direct-current transmission. (2) The choice of a maximum voltage as close to the effective voltage as possible, which again means direct-current transmission.

The most serious objection that will at once be raised is that no reliable high-tension commutator or acyclic generators or motors exist for high-tension direct-current systems. However, when it is considered that in a single installation over $1,000,000 may be saved by using direct-current instead of the present form of transmission, it may be worth while to spend some money on development, and in view of the vast amount of ground work done by Thury in Switzerland, it seems not improbable that high-tension direct-current transmission may find its field after all.

CENTRAL-STATION PRACTICE

Transmission—Interior Wiring

AN EXAMPLE OF RECONSTRUCTION WORK.

SOME CHANGES IN THE PLANT OF THE JANESVILLE ELECTRIC COMPANY.

The work here described is noteworthy on account of the fact that the large bulkhead wall of an old stone flume, which had been supported by tie-rods and which carried a building of considerable size and weight, was removed and a concrete bulkhead wall supported by buttresses was installed in its place, the remainder of the old construction being preserved.

FIG. 1.—OLD STONE WALL.

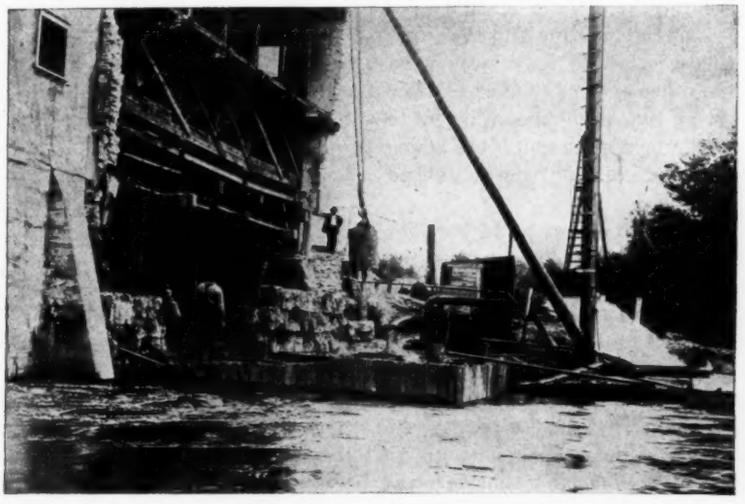


FIG. 2.—RECONSTRUCTION WORK IN PROGRESS.

One of the generating stations of the Janesville Electric Company, located on the Rock River, was originally constructed to furnish power to a cotton mill, the old turbines being installed in a stone flume, which was covered by a portion of the mill. In 1906 a concrete flume was built to supply two new turbines, which were installed to enable the company to utilize water which had hitherto been wasted, and to use the water at ordinary stages under more economical conditions. In constructing the wheel pits and discharge pits of the new turbines an interesting condition arose. When the discharge pits had been sunk to within about two feet of the desired depth a small jet of fine sand began to force up through the gravel. This indicated the presence of a sand pocket somewhere in the vicinity, from which the sand was being forced out into the excavation. The rapidity with which the work was being carried forward was increased to the greatest practicable extent, and the required depth was reached about the time that cracks began to develop in one corner of the engine-house foundation. The concrete bottom was promptly laid and no further trouble has been experienced from the sand pocket.

In 1908 it was found necessary to reconstruct the old stone flume which had been originally in service. This flume was ninety-seven feet long from the penstock gates to the bulkhead wall and fifty-four feet wide between the side walls. It carried a portion of the old cotton mill, which was a two-story brick building of heavy mill construction. The stone flume consisted of side walls extending from the gates to the stone bulkhead wall, all of the stone walls being approximately three feet thick when built. Extending from the penstock gates to within approximately seven feet of the wheels were two stone division walls, which divided the penstocks into three parts and served as supports for the columns of the cotton mill. For a distance of forty-three feet from the penstock gates the flume was arched over with stone, the remainder of the flume being covered by the cotton mill. The bottom of the penstocks was of heavy planking and the bottom of the discharge pits consisted of two layers of ten-by-ten-inch timbers, the first timbers being laid parallel with the shaft connecting the turbines and the second layer being at right angles to the shaft, the whole being planked over with three-inch planking. A narrow stone apron adjoined the discharge pit floor. The old wall is shown in Fig. 1, and the location of plates for tie rods can be clearly seen.

In 1908 this wall had disintegrated until it was in places only six inches thick. It was apparent that something must be done at once if this portion of the plant was to be kept in operation. It was decided that the best thing to do was to tear out the old

wall and replace it with a concrete wall supported by buttresses instead of tie rods, leaving the major portion of the older structure intact. The prosecution of this plan involved the supporting of the floors and roof over the old bulkhead wall so that this wall might be removed without disturbing the remainder of the structure. It was impracticable to support the building from the floor of the flume, since it was probable that this floor would also require replacement. The work of tearing down the wall was commenced at the same time that the sheet pile cofferdam, which was to make possible the complete drainage of the wheel pits and therefore their examination, was being installed.

The plan pursued was as follows: Two fifteen-inch "I" beams were placed lengthwise of the penstocks about one foot above the first-floor level and directly over the flume division walls. The ends of these beams extending under the part of the building which was to remain undisturbed, were securely held down by braces to the joists of the building and the joists over the wheel pits were supported from the other ends of the beams. The beams were thus used as cantilevers to support the part of the building which normally rested upon the bulkhead wall.

Fig. 2 shows the beams and bracings viewed from the river side after the bulkhead wall had been removed.

A guyed derrick mounted on a scow was used to handle the stone removed from the building wall, which was deposited to form a breakwater in such a manner as to protect the plant from the current of the river and to give a slight ejector effect and thus increase the head acting upon the water wheels.

Upon the pumping out of the wheel pits it was found that the timber floor was in a good state of preservation and would not require renewal.

An examination of the old stone apron showed that it rested solidly upon gravel and was in a good state of preservation. It was, however, too narrow to satisfactorily support the buttresses for the new construction, so it was decided to extend the apron out a distance of two feet for its entire length with a reinforced concrete plate, and at points where the buttresses were located to carry this concrete apron out a distance of eleven feet from the face of the new concrete wall. Gravel for the concrete was obtained from a nearby pit and a mixture of one part cement to five parts gravel, run of the bank, was used for the work.

The concrete wall, which is shown in Fig. 3, is two feet thick and extends the total width of the flume. It is supported from beneath by the iron supports formerly used for the stone wall and is prevented from overturning by four buttresses each eighteen inches thick. The concrete wall and buttresses are steel-reinforced.

At each end of the bulkhead wall the old stone walls forming the sides of the flume were removed for a distance of a couple of feet behind the line of the bulkhead, and where the concrete was to come in contact with them they were thoroughly washed down and cleaned with a wire brush before the concrete was placed. This gave a good binding contact.

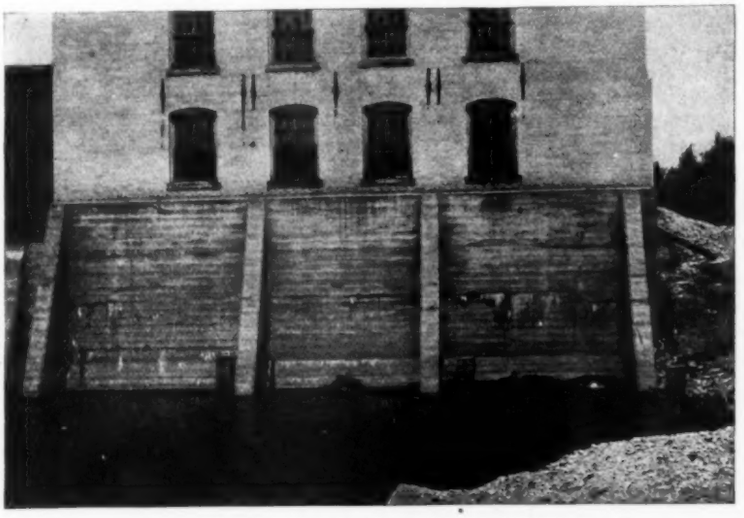


FIG. 3.—VIEW OF REINFORCED CONCRETE WALL.

The hydraulic equipment of the plant now consists of three water wheels of 250-horsepower capacity, and two of 100-horsepower capacity. With this and other stations the company now supplies energy to over seventy-five per cent of the manufacturers of Janesville, which is a city of 15,000 inhabitants, and in addition there is a large lighting load. The engineers in charge of the reconstruction were D. C. & William B. Jackson.

Pensioning Power Employees at Niagara Falls.

Announcement has been made by several power companies at Niagara Falls that a system of pensions for all employees became effective on January 1. All persons in their employ for ten years will be retired at the age of sixty-five and may be pensioned at $20 to $100 a month.

Every employee at fifty, after fifteen years' service, who shall be incapacitated for any position the company may have available may be retired and pensioned. Accepting a pension will not bar pensioner from engaging in other business, but no person who shall have forced the company, within three years of retirement, to pay a claim for damages shall be entitled to a pension.

Hydroelectric Power in Japan.

From an industrial standpoint the problem of developing cheap hydroelectric power in Japan is of great importance. Coupled with cheap labor, electric power may enable Japan to become a competitor with other countries in numerous lines during the next ten years.

Some experts assume that there are only a few large projects which can be safely developed with assurance that large units of power could be had—that is to say, upward of 20,000-horsepower plants—but promoters estimate that there are 500,000 horsepower available in the vicinity of Tokyo alone, and that Tokyo requires 125,000 horsepower at the present time. Hydroelectric promoters declare that they have confidence in their ability to locate power plants throughout the country that will total between 1,000,000 and 2,000,000 horsepower.

ELECTRIC LIGHTING and ILLUMINATING ENGINEERING

REFLECTION CO-EFFICIENTS.[1]

BY PAUL F. BAUDER.

At present an illumination plan for any given interior does not lay sufficient stress upon the color requirements of the lighting source, whether natural or artificial, combined with the walls, ceiling, floor and contents of the given interior. In order to present more fully the importance of the above details in the illumination specifications for given interiors one must consider not only the efficiency of the lighting sources with which the illuminating engineer must work, but likewise the combined artistic and architectural effect produced by the given installation.

An immense amount of work has been done to impress upon the mind of the engineer, as well as the general public, the fact that certain sources of light compare closely to what has been termed daylight. Investigations have been carried out to disprove such statements, and there is no tendency, at the present time, to describe an artificial illuminant as one which will produce daylight. No artificial illuminant, as at present manufactured and installed, can combine intensity, color value, direction, brilliancy, volume and diffusion of light, in the same manner as they occur in natural light installations.

When artificial light sources are compared upon the afore-mentioned basis with daylight as a source, one is at once brought face to face with the fact that none is at present able to approach, except in a very small degree, the effect obtainable from daylight. The most important consideration is entirely missing, namely, the lack of adaptability of artificial sources to given interiors.

In making final decision as to what type of artificial illuminant should be used in lieu of daylight the illuminating engineer is initially impressed with the failure of the artificial source to give anything like satisfactory results, from the standpoint of color values obtained, as compared with the same results obtained from daylight.

The second item that is usually considered in connection with the commercial use of any given type of illuminant is the efficiency of operation. Excluding this the engineer usually accepts any given type so as to meet his individual commercial inclinations.

The third detail, which is considered the most important, is to cover a given area with a proper intensity of light by the use of the selected sources. It is true that the location of the given light source is usually made to conform to the given architectural requirements. It has been contended, however, by several authorities that the selection of given illuminants should depend primarily upon the color of light and reflector, color of interior surfaces, character of work to be done under the given light, etc., all of which items must be decided upon primarily from the consideration of what effect a given light has upon the average human eye.

With all of the developments which have been made in the manufacture of light sources, it has been a surprise to find that nothing radical has been done by paint, paper or tapestry manufacturers to make any given interior decorative materials harmonize with given light sources any better than they did when less efficient and thoroughly unsatisfactory methods of illumination were in general use.

The excellent paper presented before the New York Section of the Illuminating Engineering Society last March by C. R. Clifford indicates in a general way what should be considered from an aesthetic standpoint in the relationship of decoration to the illuminating engineer. In order to obtain the basis for a further estimate as to the importance of reflection and absorption in planning interior illumination, there are presented in the accompanying table the results obtained by Dr. Herbert E. Ives for a 3.1-watt-per-candle carbon and a 1.25-watt-per-candle tungsten lamp, as to energy flow and sensation values, and which are shown in a paper presented before the Society on March 17, 1910.

ENERGY-FLOW VALUE BY WAVE LENGTHS—SENSATION VALUES.

Source	0.43	0.47	0.51	0.55	0.59	0.63	0.67	Red	Green	Blue
Blue sky	185.0	180.0	146.0	120.0	100.0	87.0	77.0	26.8	27.2	46.0
								32.0	32.2	35.8
Carbon lamp	7.0	18.0	34.5	62.0	100.0	148.0	204.0	50.9	40.6	8.5
								51.3	40.4	8.3
Tungsten lamp	10.2	22.8	40.5	66.5	100.0	138.0	179.0	47.9	41.1	11.0
								48.7	40.5	10.9

As noted from the above table the energy-flow value by wave lengths for the carbon and the tungsten lamp varies considerably from the values for blue sky. The comparison for the wave lengths given between the carbon lamp and the tungsten lamp show considerable variation in the actual energy-flow values of these two incandescent lamp sources, and when considered in connection with the sensation values of red, green and blue, it is immediately noted that the various colors composing the spectra of these two sources can be turned to more efficient value by not only using the proper reflector, but likewise the proper interior surface coverings, in such locations as either of these two sources may be used. So great is the variation of these light sources from the color of daylight that interior decorations, from an artistic and chromatic standpoint, cannot be satisfactorily selected for only daylight effect, but should be selected with considerable attention to the effect which is produced in the interior when artificial illumination is used.

Present conditions of living require the use of such a great number of hours of artificial light that particular attention should be paid to the use of given interiors when artificial light is used, in order to obtain not only maximum lighting efficiency, but likewise maximum artistic effect, from the complete installation of light source and surroundings.

1 Abstract of a paper presented at a meeting of the New York Section of the Illuminating Engineering Society, January 12, 1911.

In order to appreciate more fully what effects are produced by the various colors of light forming the spectrum of any given source, attention may be called to the following table, showing the various effects accentuated with red, green and blue light falling on various fabrics of red, green, blue and white.

EFFECT OF COLORED LIGHTS ON ANILINE-DYED MATERIALS.

Red	rays	falling	on	white	make	it	appear	red.
"	"	"	"	red	"	"	"	deeper red.
"	"	"	"	green	"	"	"	yellowish gray.
"	"	"	"	blue	"	"	"	violet.
"	"	"	"	black	"	"	"	rusty-black.
Green	"	"	"	white	"	"	"	green.
"	"	"	"	red	"	"	"	yellowish brown.
"	"	"	"	green	"	"	"	deeper-green.
"	"	"	"	blue	"	"	"	bluish green.
"	"	"	"	black	"	"	"	dark greenish gray.
Blue	"	"	"	white	"	"	"	blue.
"	"	"	"	red	"	"	"	purple.
"	"	"	"	green	"	"	"	bluish green.
"	"	"	"	blue	"	"	"	deeper-blue.
"	"	"	"	black	"	"	"	bluish black.

It is not possible to consider an installation of given sources of light solely from the standpoint of color values which are retained, or slightly changed, but the incorrect use of the lighting source for given interior decorations is liable to fail completely in producing a pleasing or satisfactory effect. Other considerations must be met by such installations of lighting sources, some of which have been previously noted.

The application of many of the characteristics of daylight—chief among which is diffusion of light—cannot be obtained by the use of artificial illuminants, no matter in what way they may be used. If it were possible to diffuse the light from a given artificial source and if this diffusion could be obtained in a fashion similar to that in daylight, many of the difficulties of interior illumination would be eliminated. The importance of properly diffusing the light has been given no serious consideration by the manufacturers of interior finishings, such as paint, wall paper, tapestry, etc., applied to walls, ceilings, floors, furniture, etc.

It is impossible to obtain the diffusion of light which occurs in nature by suspended particles of foreign substances in the air, but it is possible to obtain diffusion of light as satisfactorily as it is obtained in nature by diffused reflection from various surrounding objects, such as the ground and building surfaces. The proper application of artificial lighting units to interiors should allow for the correct diffusion of the light by surface reflection.

Particular attention, it is true, is paid by the interior decorator to the artistic and aesthetic values of any interior furnishings, including, likewise, the lighting unit. Due to the fact that sufficient authentic data is not at hand, it is to be doubted if the proper amount of consideration has been given to the adaptation of proper interior surface coverings to be used to obtain maximum diffusion of light as well as the most artistic and efficient illumination.

A proper psychological effect with a given installation cannot be produced without the use of some type of wall, ceiling and floor covering, which is best adapted for use with a given type of light source, combined with a given type of reflector.

Many times the pleasing effect obtained from the use of given interior finish for walls, ceiling, floor and decorations, is not by any means the most efficient combination which can be obtained from a lighting standpoint. Many times the lighting source is so hidden by the use of shades that the actual amount of light delivered to the room is only a few per cent of the total amount of light generated by the source itself. This condition can easily be remedied if the proper attention is given to the selection of any one of several types of artificial lighting sources, combined with properly tinted reflectors.

The results which can be obtained by the use of different types of reflector with two different types of interior decoration are recorded by A. L. Parsons and H. W. Smith in a report upon "The Illumination of Study Rooms," submitted to the Superintendent of the Naval Academy in Annapolis.[2]

Some of the conclusions which were obtained from the large amount of data are as follows:

That re-decorating the rooms (in which the tests were carried on) decreased their apparent height, and rendered their general aspect more pleasing. The tint of the ceiling decreased somewhat the illumination over the working area, but this loss in efficiency was not sufficient to warrant the retention of the dead-white surface.

That a very substantial part of the illumination is due to reflected light from walls and ceiling.

The effect which might have been obtained from a proper combination of lighting source and reflector tinted to some shade matching the colors of the light source as well as those of the redecorated room, would have materially increased the artistic if not the lighting efficiency.

So far as the author is aware, no results of a definite character have been submitted to the Illuminating Engineering Society as to the use of reflectors of different tints of glass with the different types of interior wall, ceiling and floor coverings. It is true that an interior of any one size could not be taken as a standard from which to work out the effects produced by the use of such types of reflector and lighting source as are commercially used at the present time.

The results obtained by F. H. Gilpin, as recorded in the paper presented before the Philadelphia Section of the Illuminating Engineering Society, on October 21, 1910, show the effect of the variation of the incident angle on the co-efficients of diffused reflection. This paper contained a most interesting explanation of results carried on with the lighting source, an upright-mantle gas burner with a clear chimney. The results obtained clearly indicate that various kinds of paper, such as were used, vary greatly in their efficiency of diffused reflection. The table of data, if properly used, indicates the scope of work which can be done in continuing the results of these investigations to many different types of wall, ceiling and floor covering, for the architect, interior decorator and finisher. The following conclusions by Mr. Gilpin are of interest in application to the present paper. "For high, narrow rooms, for indirect lighting, or where the lamps are placed near the walls, a glossy paper will give the best results; while for wide, flat rooms, or centrally located lamps, the difference between the rough and the smooth papers would be practically negligible."

Tests which were carried on by the author about two years ago were made in conjunction with a study of the quality of light of various artificial lighting sources, as compared with daylight. The tests were carried on in a room ten feet square by ten feet high, and the wall coverings were varied from white to red, green and blue while the floor

2—See ELECTRICAL REVIEW AND WESTERN ELECTRICIAN, August 27, 1910, pp. 428-429.

was white in the first instance, after which the covering was removed leaving a dark wood floor. The illuminants used in this case were clear incandescent lamps in extensive-type prismatic reflectors, and the results of the illumination in foot-candles were obtained by the use of an illuminometer at different stations.

The object of obtaining these values was to determine the co-efficients of reflection for colored wall coverings as compared to a room having white floor, walls and ceiling.

Previous to carrying out the tests of illumination in the room above described, the color values of the fibrous red, green and blue paper wall coverings were taken with a colorimeter, and compared with daylight, as standardized by several lamps obtained from the Bureau of Standards, at Washington. These lamps had in turn been compared with the then adopted average standard of daylight obtained by Dr. Herbert E. Ives. The magnesium was replaced by a strip of each of the wall coverings, red, green and blue. The resulting values are as shown in the following table:

COLORIMETER READINGS OF VARIOUS TYPES OF WALL PAPER IN TERMS OF STANDARD DAYLIGHT.

Type of Illuminant.	Color of Surface on which Light Falls.											
	White			Red			Green			Blue		
	R.	G.	B.	R.	G.	B.	R.	G.	B.	R.	G.	B.
Daylight	100	100	100	190	89	100	91	171	100	57	122	100

Blue is taken as 100 in each case.

Several types of artificial illuminant were likewise used without reflectors to obtain the colorimeter values of the various wall papers which were hung in the test room. The incandescent lamps were so placed as to allow the maximum flux to fall normally upon the surface of the wall paper.

These measurements of the sensation colors of the various surfaces upon which the light of each illuminant fell are indicated in the accompany table:

COLORIMETER READINGS OF VARIOUS ILLUMINANTS.

In terms of standard daylight = Red 100, Green 100, Blue 100.

Type of Illuminant—	White			Red			Green			Blue		
	R.	G.	B.	R.	G.	B.	R.	G.	B.	R.	G.	B.
Treated carbon	2575-	1361-	100	12080-	1850-	100	2170-	1966-	100	481-	345-	100
Graphitized carbon	1342-	788-	100	8380-	1525-	100	1071-	812-	100	421-	324-	100
Tantalum	1099-	592-	100	3429-	640-	100	1171-	877-	100	242-	204-	100
Tungsten	780-	462-	100	1850-	362-	100	655-	670-	100	209-	178-	100

A comparison of these results with those given in the previous table indicates the extent to which the artificial illuminants fail to approach the daylight values.

In making the illuminometer tests mentioned, the incandescent lamp sources, in extensive-type clear prismatic reflectors, were suspended about two feet below the center of the ceiling.

The same reflector with different types of holder, corresponding to the lamp, was used for all of the tests. The incandescent lamps were photometered at rated specific consumption and the resultant constant voltage was maintained upon them during the test.

The sizes of the various lamps are as follows:

INCANDESCENT LAMPS USED IN TESTS.

Type.	Specific consumption, watts per candle.	Total consumption watts.	Approximate candle-power.
Treated carbon	3.1	60	20
Graphitized carbon	2.5	50	20
Tantalum	2.0	40	20
Tungsten	1.25	25	20

The values for the several differing conditions of wall covering are not given, as these values were reduced to percentages of absorption as follows:

The white-room (walls, floor and ceiling) values have been assumed to be maximum, and the illuminometer values for the rooms draped in red, green and blue have been expressed in percentages of reflection as indicated in the foregoing table.

From the figures indicated in this table it is proven that, for the test room used, the absorption of light is a most important item. The variation occurring from the use of various colors of wall paper in comparison to white wall and floor coverings is not as great as was expected before the tests were made.

It is, nevertheless, evident that various results for higher efficiency of illumination could have been obtained if a different style of reflector had been used.

With decorative styles of shade, such as are given in the next table it is readily seen what an immense improvement has been made in obtaining higher lighting efficiency from reflectors over that obtained with the more or less strictly decorative styles of glassware.

EFFICIENCY OF GLASS GLOBES.

Description.	Absorption Per cent.	Efficiency Per cent.
Clear glass	5-12	88-95
Light sand blast	10-20	80-90
Alabaster	10-20	80-90
Canary colored	15-20	80-85
Light blue alabaster	15-25	75-85
Heavy blue alabaster	15-30	70-85
Ribbed glass	15-30	70-85
Opaling glass	15-40	60-85
Ground glass	20-30	70-80
Medium opalescent	25-40	60-75
Heavy opalescent	30-60	40-70
Flame glass	30-60	40-70
Signal green	80-90	10-20
Ruby glass	85-90	10-15
Cobalt blue	90-95	5-10

Note.—Light source not known.

From these results it is shown to what extent the use of inefficient globes decreases the efficiency of the source. Similar results should be obtained for interior decorations in order to combine the lighting source and interior as a complete illumination system rather than to consider each separately.

PER CENT REFLECTION IN TEST ROOM.

Illuminant.	Station 1			Station 2		
	Red Walls.	Green Walls.	Blue Walls.	Red Walls.	Green Walls.	Blue Walls.
Treated carbon	57.60	54.20	47.30	53.60	49.10	43.60
Graphitized carbon	56.95	51.85	46.90	48.40	47.80	44.65
Tantalum	50.60	49.00	45.75	49.35	50.10	47.90
Tungsten	49.15	51.60	50.90	47.45	51.70	49.97
	Station 3			Average		
Treated carbon	48.97	42.40	40.80	53.39	48.57	43.90
Graphitized carbon	47.25	48.40	42.00	50.85	49.35	44.55
Tantalum	47.86	49.70	44.68	49.27	49.60	46.11
Tungsten	45.0	49.95	50.26	47.20	51.08	50.38

Note —All stations 28 inches above floor.

For certain locations there is more of a necessity to direct the light at once, without wall or ceiling reflection, upon the work at hand, and in order to accomplish this result steel reflectors of various surface finishes have been adopted. A considerable loss occurs, as the efficiency of reflection varies from sixty to sixty-five per cent according to the type of reflector, but the results from a correct illumination standpoint are apparently warranted.

A great deal has been and is being done by incandescent lamp and reflector manufacturers to increase the lighting efficiencies of the various styles of reflector, and the possibilities for manufacturers of interior decorations, such as art glass, wall hangings, etc., include a field of immense dimensions.

The illuminating engineer must, at the present time, determine for himself the many diverse details of not only the efficiency and adaptability of a given lighting installation, but likewise the utilitarian and artistic effect produced.

The intention of this paper is merely to indicate in a small measure what a necessity there is to consider the importance of reflection and absorption of light in obtaining the best from any installation of light sources.

Magnetic Observatory for Italy.

It is proposed to erect a central magnetic observatory in Southern Italy.

The Metal-Filament Lamp and Electric Lighting in Germany.

In a recent report United States Consul W. T. Fee, of Bremen, Germany, gives some interesting facts regarding the manufacture, sale and use of tungsten and tantalum lamps in Germany.

There are three large German companies and several small ones which manufacture these lamps. The manufacturers are not under strict association rules regarding manufacture, output, sale, etc., of their product on the Continent, except that the price to the dealer and jobber of all standard wattage must be held to a certain established point. In foreign countries, other than on the Continent, the markets are open.

The prices to the consumer are upheld by a dealers' union agreement. The prices of lamps to the consumer are as follows, lamps of 100 watts and over being made in meridian type only:

	Standard.			Meridian.		
Watt—	Price.	Tax.	Total.	Price.	Tax.	Total.
16.....	$0.55	$0.05	$0.60	$0.58	$0.05	$0.63
32.....	.60	.10	.70	.58	.05	.63
50.....	.60	.10	.70	.58	.10	.68
100.....	....	....	....	1.27	.15	1.42

The government tax, which is shown in the table, has been increased three times, and judging from past history, is likely to grow. There is a customs duty of 80 marks per 100 kilograms in weight levied upon all incandescent electric lamps imported into Germany. The duty, therefore, on a standard lamp of thirty-two watts is about one cent. The manufacturers do considerable advertising in magazines, trade journals, and on billboards throughout the country.

The standard lamps, as a rule, are constructed about the same as the American, except that the pear-shaped bulbs are longer, narrower, and have smaller skirts. The bulb capacity per candlepower is also less.

The sixteen-watt tungsten is supplied in a bulb similar to the American twenty-five watt tantalum lamp. It has not given satisfaction, as the life is too short, and the percentage of breakage is high. It is very little used. The thirty-two-watt tungsten is the popular lamp for general use in Germany. Frosted lamps are seldom seen. Those in use are generally dipped by the dealer and are inferior. Sand-blast frost is not used.

The candlepower, the wattage, and the voltage are marked on the skirt of the lamp. The name of the company or the trade-mark is etched on the bulb. Gummed paper labels are not used. The lamps are designated by their candlepower, not by their wattage, as in American practice, but the wattage and the candlepower at the indicated voltage are about the same. The specific consumption in the German and American lamp is approximately the same.

In the tungsten lamp the leading-in wires, up to the platinum weld, are of three or four small strands of copper wire. In the stem there is no cork or wad to prevent short-circuit in the leading-in wires except in lamps of 100 watts and over, in which a small piece of cork is used. One company claims a life of 2,200 hours for its lamps. However, 1,000 to 1,400 hours is considered a good average life.

The German method of packing lamps is similar to the American, but not so expensive. The low percentage of breakage in handling lamps is an interesting factor. Breakage in transmission is low. The percentage of breakage, for instance, from Berlin to Bremen (about 200 miles) is below two per cent, at the highest estimate. The broken lamps received by dealers are immediately returned to the manufacturer, together with the empty cases. The case is always returned; it does not form a part of the sale. When the next order for lamps is filled good lamps equalling the number of broken ones are shipped without charge. The manufacturers are very liberal on the return breakage proposition, which might be expected, as there can be no such long hauls as are common in the United States.

Germany is the home of the municipal central station. This means a difference in a good many problems connected with lamps, compared to those arising under the jurisdiction of a leased or corporation-owned plant. In some cities the city lighting plant supplies lamps to all consumers of its current. Again the central stations may not handle lamps at all, except for their own use. In any case there are no halfway measures. The dealer is either protected and given a whole territory or he is not allowed to handle lamps. In the majority of cases, however, the central station supplies lamps to the city and leaves the consumer to the jobber.

In lighting parks, public gardens, etc., the tantalum lamp is mostly used. The lighting standards are generally well designed. The lamp is usually incased in a glass globe for protection. The shade is of white enamel. Owing to the method of placing lamps, the pathways and especially the streets, are often unevenly lighted. The use of shades and reflectors could be improved. Much light is lost by imperfect reflection and distribution. A desire for artistic design in the style of chandeliers, shades, globes and reflectors has prevented the selection and proper placing of units and reflectors best suited to the requirements of a given installation.

A low-voltage street light is seldom seen. The tungstens used are the ordinary lamps. They are burned below their indicated voltage, and in most cases give about the color of carbon lamps.

The tungsten has practically supplanted the old carbon lamp in railroad stations, tunnels, public buildings, gardens, public resorts and hotels, as well as in the greater number of residences. Great advances are also being made in factories. One sees tungsten lamps everywhere. However, the yearly output of carbon-filament lamps has not decreased since the introduction of high-efficiency lamps. The latter have merely widened the field and brought electric lighting into more general use.

Germany has a tremendous export trade in incandescent lamps, and it is growing every year. In 1907 it was $2,000,000 in value, in 1908 it was $4,780,000, and in 1909 it reached $7,857,000. The shipments are mostly to Great Britain, Austria-Hungary, Russia, Denmark and Italy.

London Lectures on Illumination.

The need of studying illumination has been recognized by the London County Council, under whose auspices a series of six lectures on illumination was begun on January 13 at the Westminster Technical Institute, London, England. The lecturer is J. S. Dow, and the lectures are given on each Friday. They are illustrated by the exhibition of different types of lamps and modern systems of illumination. Special reference is made to practical applications such as shop, library and street illumination.

TELEPHONY—TELEGRAPHY, and WIRELESS.

LONG-DISTANCE TELEPHONY.[1]

BY J. J. CARTY.

[During the International Conference of European Telegraph and Telephone Administrations, held at the Sorbonne, Paris, September 4 to 11, 1910, Mr. Carty, chief engineer of the American Telephone & Telegraph Company, contributed an interesting statement, setting forth some points with respect to the condition of long-distance telephony in the United States.]

The present state of the art with regard to long-distance telephony in the United States involves the use of two gauges of copper open-wire toll lines, namely, No. 12 N. B. S. G. (2.64 millimeters) weighing 173 pounds per wire-mile (48.8 kilograms per kilometer), and No. 8 B. W. G. (4.2 millimeters), weighing 435 pounds per wire-mile (122.6 kilograms per kilometer), and the use of underground and aerial toll cables with conductors varying in size from No. 16 B. & S. (1.3 millimeters), 42 pounds per wire-mile (11.8 kilograms per kilometer) to No. 13 B. & S. (1.8 millimeters), 83 pounds per wire-mile (23.4 kilograms per kilometer) paper-insulated twisted pairs. The open-wire circuits are both loaded and non-loaded, and the non-loaded circuits are frequently used in conjunction with telephone repeaters, both of the test-board and cord-circuit type. The cable circuits use in connection with long-distance telephony are invariably loaded.

In addition to the use of physical circuits there is a great deal of phantoming of non-loaded open-wire toll lines. Cable circuits are phantomed to but a small extent, however.

In addition to the foregoing, which are in actual commercial use, the development at present taking place in connection with long-distance transmission, contemplates the use of larger-gauge loaded-cable circuits arranged for phantoming and the phantom working of loaded open-wire toll lines. These points are taken up under the separate heading below.

Open-Wire Toll Lines.—At the present time the standard of transmission aimed at for long-distance work is the equivalent of about 850 miles of No. 8 B. W. G. (1,360 kilometers of 4.2 millimeters) copper circuit (about 30 miles of No. 19 cable, 48 kilometers of 0.9 millimeter). The exact distances to which it is permissible to use the different classes of constructions depend to a considerable extent on the terminal conditions, that is the amount of underground toll entering cable and the uses to which the circuit is to be put; for example, whether it is largely for terminating business or is to be used mainly in connection with other circuits. The following table shows the relative transmission efficiencies of the different classes of non-loaded and loaded circuits at present employed.

Open-wire Circuit.	Miles Equivalent to 1 mile No. 19 B.&S. Cable (0.054 m. f.)	Relative Efficiency.
No. 12 N.B.S.G. non-loaded	12.8	1.00
No. 12 N.B.S.G. loaded	30.2	2.36
No. 8 B.W.G. non-loaded	29.0	2.26
No. 8 B.W.G. loaded	67.0	5.23

In general the No. 12 N. B. S. G. (2.64 millimeters) circuits are used for the short-haul toll connections or as feeders for the long-haul toll circuits, that is for connecting the terminal points to toll centers which have long-haul facilities. The No. 12 N. B. S. G. (2.64 millimeters) loaded circuits and the No. 8 B. W. G. (4.2 millimeters) non-loaded circuits are used for long-haul toll lines. As the above table shows, these two circuits have approximately the same transmission efficiency, and the principal reason why there are any non-loaded No. 8 B. W. G. (4.2 millimeters) circuits on the plant at the present time is due to the fact that, in the days before it was feasible to load open-wire circuits, the No. 8 B. W. G. (4.2 millimeters) wires were universally used for long toll lines. Owing to the inherent characteristics of loaded lines, the loading of large-gauge aerial circuits was not made practicable until very recently. As fast as the present plans can be carried out, all of the No. 8 B. W. G. (4.2 millimeters) circuits now in the plant, and certain other circuits which will be required to take care of the long-distance traffic, are to be loaded. This new loading contemplates the arrangement of the circuits for phantom working. When this is completed the loaded No. 8 (4.2 millimeters) gauge circuits, both physical and phantom, will constitute what might be termed "extra-long-haul" circuits.

Aerial Loading.—At the present time there are about 52,000 miles (83,500 kilometers) of loaded No. 12 N. B. S. G. (2.64 millimeters) circuits in the United States, and about 1,000 miles (1,600 kilometers) of No. 8 B. W. G. (4.2 millimeters) loaded circuits. There are at present under construction or intended for completion by January 1, 1911, about 17,000 miles (27,200 kilometers) No. 12 N. B. S. G. (2.64 millimeters) loaded circuit, and about 13,000 miles (21,000 kilometers) of No. 8 B. W. G. (4.2 millimeters) loaded circuit. Of this latter about 3,800 miles (6,100 kilometers), namely, four circuits from New York to Chicago, will be arranged for phantom working.

The efficiency of these two phantom circuits from New York to Chicago is expected to be substantially greater than the physical circuits of which they are composed. Either of these two phantom circuits may be connected at Chicago to a pair of loaded No. 8 B. W. G. (4.2 millimeters) wires extending from Chicago to Omaha. At Omaha these two wires may be connected to a phantom circuit made up of four loaded No. 8 B. W. G. (4.21 millimeters) wires, now being constructed between Omaha and Denver. Over this combination of circuits it is expected, about January 1 next, that we shall be able to get a fairly good talk between New York City and Denver, Colo., and

1 *National Telephone Journal*, January, 1911.

that, by means of this and similar combinations of circuits, the value of the transmission obtained between New York and the far western cities will be very greatly increased. Over these circuits—or over sections of them—it is proposed to operate in the standard manner each wire for the purpose of duplex telegraphy which can be carried on over these wires while they are being used for telephone purposes. Thus we may have going on at the same time two independent and non-interfering telephonic conversations between New York and Chicago, also two independent and non-interfering telephonic conversations between Omaha and Denver. In addition to this, a third conversation may take place—at the same time and over the same wires—between Denver and New York. While all of these telephonic conversations are taking place, eight telegraphic messages may simultaneously be sent over these circuits, none interfering with the others nor with the telephone transmission.

Some idea of the economic importance of this loading and phantom work may be gained when I state that the re-arrangement of the circuits on the new plan between New York and Chicago is being accomplished at a cost of $110,000. The improvement in efficiency in the transmission of speech thereby obtained and the additional improved circuit which phantoming gives to us would cost $1,600,000 if obtained in the ordinary way.

With the loading coils and lightning arresters as now constructed there is very little trouble due to the failure of the loading coils, and practically no trouble due to low insulation in the arresters. These latter are also constructed in such a manner that there is practically no maintenance on them. In the early attempts to load aerial circuits one of the chief difficulties arose from inability to protect the loading coils from lightning with an arrester which did not require an excessive amount of attention, and it was largely for this reason that the early attempts at aerial loading were a failure.

At the present time the chief trouble on loaded circuits has been occasioned by low insulation due to leakage at the bridling points. This has been corrected by the adoption of the bridle-wire electrose insulator, which insures a break in the conducting path along the bridle wire.

Phantoming. — The phantoming of non-loaded circuits involves the use of phantom repeating coils on the component side circuits. These coils necessarily introduce a certain amount of transmission loss so that the efficiency of the side circuits is slightly reduced. The phantom circuit produced is, however, considered more efficient than the original side circuits, and where phantoming is adopted in the toll plant it is usual to arrange the traffic so that the long-haul connections will be put up on the phantom and the shorter-haul connections on the side circuits.

Loaded Phantoms.—By properly arranging the windings on the loading-coil cores, by observing extraordinary precautions in the manufacture and by constructing special coils arranged for four sets of windings, it is possible to phantom loaded circuits and to load the phantom thus produced. The impairment in the efficiency of the loading side circuits due to the introduction of the phantom loading coil is slight, and the loaded phantom has materially higher transmission efficiency than either of the side circuits.

By the adoption of this phantom loading, the preliminary work on which is just being completed, one of the chief drawbacks to the extensive use of aerial loading will be overcome, and at the same time the range of transmission will be considerably increased. The limitation to loading which has existed in the past, due to inability to phantom the loaded circuits, has been due to the fact that it has been necessary to choose between the economies of phantoming with practically no increase in the transmission range, or to load the physical circuits, thus extending their transmission range, and to provide additional physical circuits to care for increased traffic. With phantom loading both benefits will be available.

Superimposed Telegraph.—All of the long-distance toll lines are used for superimposed telegraph working. This applies also to phantom circuits. Both simplex and composite combinations are in use. Both involve grounded telegraph operation. In the first of these the two wires of a pair are used in parallel as a telegraph conductor, and in the second each wire is used as a separate telegraph circuit. Straight and duplex Morse working are in vogue, and while automatic keys are used to a considerable extent, there is no present operation of high-speed machine sending. The loading of circuits does not interfere in any way with their applicability for telegraph purposes except that it places a limitation on the maximum value of the telegraph current, *i. e.*, it is not possible to employ such currents as will magnetize the loading-coil cores.

Cable in Connection With the Long-Distance Telephone Service.—Paper-insulated cables are employed for two purposes in connection with the long-distance telephone plant (this does not include the use of cables for toll switching trunks). The first of these is for bringing open-wire toll lines into the centers of cities where it is not possible to install and maintain open-wire leads, and the second is for use between large toll centers where the volume of terminating traffic is such as to require a large number of circuits. Under these conditions it is economical to install underground toll cables for very considerable distances. For both classes of service the cables are invariably loaded.

Toll Entering Cables.—Cables for toll entering purposes range in size from No. 16 (1.3 millimeters) to No. 13 B. & S. (1.8 millimeters) gauge conductors, depending upon the character of the open-wire toll lines, and are loaded light, medium or heavy, depending upon their length, upon whether the open-wires are non-loaded or loaded, and upon whether the toll switching trunks are non-loaded or loaded. As the number of circuits in the toll entering cables is always in excess of the number of toll lines to be brought in, considerations of the warranted expenditure for a given transmission gain, result in the cable conductors being somewhat smaller than those of the open-wire lines which they are to serve. In determining the proper gauge of any toll entering cable, this cable is so arranged as to be in cost-equilibrium with the open-wire plant which it is to serve.

Duplex Cables.—At the present time practically all of the toll entering cables are of ordinary construction, that is, not arranged for phantom working. Duplex cables and proper loading coils for use on them have recently been devised and are being installed. The employment of such cables will make it possible to employ phantoming of the open-wire plant to full efficiency as it will remove the necessity

of placing the phantom repeating coils on the outer end of the toll entering cable by permitting the phantom circuits to be carried into the toll office, as such, thus making all the wire available for composite operation.

Toll Cables.—Between certain large cities—for example, between New York and Philadelphia, New York and New Haven, Chicago and Milwaukee, Boston and Worcester, Boston and Brockton—the volume of traffic is sufficient to warrant the provision of special high-grade loaded cable circuits in underground conduit. At the present time these circuits are in cables of ordinary construction; that is, not arranged for phantom working, and are usually provided with heavy loading. To provide the necessary transmission efficiency the cable conductors for the long-haul circuits are usually No. 14 (1.6 millimeters), or No. 13 B. & S. (1.8 millimeters) gauge. A certain number of smaller-gauge conductors for service to intermediate points are frequently incorporated in the same cable sheath. The standard full-sized sheath is 2.625 inches (66 millimeters), outside diameter, and the sheath thickness is 0.125-inch (3.2 millimeters). The paper-insulated conductors have a mutual electrostatic capacity of about 0.068 microfarad per mile (0.042 per kilometer).

In cases of this kind, where a large number of circuits are provided in a single sheath, special rapid operating methods are in vogue. The circuits are also employed for superimposed telegraph working.

Extension of Underground Working.—At the present time we are preparing to install an all-underground cable route from New York to Washington, a distance of 235 miles (378 kilometers) and from New York to Boston, a distance of 235 miles (378 kilometers). The cable in these routes is to be of special duplex construction, that is, arranged for phantom working, and both the side circuits and the phantom circuits are to be loaded. The cable will be of standard size and will contain seven quads No. 10 B. & S. (2.6 millimeters) conductors, eighteen quads No. 13 B. & S. (1.8 millimeters) gauge conductors, unphantomed, and eighteen pairs of No. 16 B. & S. (1.3 millimeters) gauge conductors unphantomed. The loaded No. 10 (2.6 millimeters) gauge physical and phantom circuits and the loaded No. 13 (1.8 millimeters) gauge phantom circuits will give a high grade of transmission from New York to Washington or Boston, and the No. 13 (1.8 millimeters) gauge loaded side and non-phantomed circuits will give transmissions to intermediate points. No. 16 (1.3 millimeter) gauge conductors will be used for short-haul service along the route and for telegraph operation.

It will be seen that over the circuits of this cable, phantom working will be accomplished; superimposed telegraph working will also be used, so that over two pairs of wires three independent telephone conversations may take place simultaneously, and at the same time eight telegraph messages may be sent, all without interference.

Phantom Loading Coils.—With the standard coils now in use it is not possible to secure efficient phantom working. The coils have, however, been redesigned to eliminate this difficulty, and in the future all coils are to be manufactured so that they may be employed on duplex cable. In the case of the New York to Washington and New York to Boston cables the associated side circuit and phantom loading coils will be mounted in the same pots, all of the cross-connecting being done at the factory. The plant force will, therefore, have simply to connect the stub cable into the main cable.

Telephone and Telegraph in Switzerland.

The general use of the telephone and telegraph in Switzerland is due to the fact that excellent facilities for communications are provided. Practically every postoffice in the country is provided with a public telephone and telegraph, and every community, no matter how remote, is supplied with both services. Rates are low, and every inducement is offered to the public to use the telephone and telegraph as means of communication.

The telephone rates to subscribers for each call, for a conversation lasting three minutes, are as follows: Within the city, town, or community in which the telephone is located, one cent; interurban calls, not exceeding thirty-two miles, six cents; not exceeding sixty-four miles, 10 cents; exceeding sixty-four miles, anywhere in the country, fifteen cents; for night service the last three divisions are four, six and nine cents, respectively.

The telegraph service is also inexpensive, the rate being six cents for each telegram and half a cent per word, making the cost of a ten-word telegram eleven cents, or sixteen cents for a twenty-word message.

The cost of administration of the telegraph and telephone service for the year was $2,222,000, and the receipts $2,223,000, leaving a balance of $1,000 profit to the government.

The total number of telegrams sent and received during 1909 was 5,202,969, which are classified as follows: Within the Republic, 1,557,450; international, 2,541,454; in transit, 1,104,065. The percentages of business for the year is classified as follows: Telegrams for the federal and local governments, 1.96; for the various stock exchanges, 2.81; commercial, 36.05; private, 58.18; the press, 1.0.

The telephone statistics give the following for the year: Local calls, 41,417,376; interurban or long-distance calls within the country, 8,879,537; international calls received, 259,095; sent, 253,354; international calls for which no fees were charged, 140,600. Total interurban and international conversations, 9,532,586; total conversations, 50,949,962; telegrams transmitted by telephone, 391,719; total telephonic communications for the year, 51,341,681. The population of Switzerland being about 3,500,000, the foregoing service shows that there were one and one-half telegrams and about fifteen telephone communications per capita during the year.

Telephone Cable to Prince Edward Island.

Telephone communication between Prince Edward Island and the other maritime provinces of Canada is now established. A second cable has been laid across Northumberland Strait, from Cariboo Island, to Wood Island, near Charlottetown. The distance is about thirty-five miles. This new cable carries telegraph and telephone wires. For the present direct telephone communication is limited to points between Prince Edward Island and the larger cities in New Brunswick and Nova Scotia. Communication between Charlottetown and points in the United States is possible only by repeating messages at St. John, New Brunswick, and Halifax, N. S.

THE REGULATION OF RATES BY PUBLIC-SERVICE CORPORATIONS.

AN IMPORTANT DECISION BY THE SUPREME COURT OF THE STATE OF OKLAHOMA INVOLVING THE REASONABLENESS OF RATES CHARGED BY TELEPHONE COMPANY.

In the case of the State of Oklahoma and others against the Pioneer Telephone and Telegraph Company, operating a local telephone exchange at Enid, and toll and long-distance lines to other parts of the state, the Supreme Court has handed down an important decision, involving the reasonableness of rates charged by a telephone company apparently establishing the law governing regulation of rates by public-service corporations in that state.

The case reached the Supreme Court from the Corporation Commission of that state and the opinion and decision of the Supreme Court involved a discussion of the question of the valuation of the property, the right and obligation to create a depreciation reserve fund and the rate of return, these three questions being the subject of contention between the Company and the Commission.

The Supreme Court of Oklahoma followed closely the decisions of the Supreme Court of the United States in the recent Consolidated Gas Company case and the Knoxville Water Company case and is along most conservative lines, which must give great comfort and encouragement to all investors interested in public service corporations operating within the State of Oklahoma.

Adopting a ruling of the Supreme Court of the United States that the present value of the property used in furnishing the service is a basis upon which to measure the reasonableness of the rates in question, the Supreme Court held that in valuing the property of a public service corporation dedicated to the use of the public, such valuation should not be limited to the value of the physical tangible properties so used but must include the value of the property as a "going concern." The court said upon this point, among other things:

"There is no contention that any value on account of unexpired franchise or for good-will should be added to the reproductive value in order to ascertain the present value, but it is contended that by reason of the fact that appellant's plant has an established system of operation, has at present customers sufficient in number to pay the operating expenses and annual depreciation and some profit, it has a value beyond the mere cost of reproducing the plant. This element of value contended for has been generally referred to by the authorities as the 'going concern value,' or 'going value.'

"It is apparent, however, that a complete telephone plant, without a single subscriber, or with but few subscribers, is less valuable to both the owner of the plant and to the members of the public it serves than the same plant with large patronage. The more people a subscriber can communicate with over a telephone exchange, the more service, as a general rule, is such exchange to him; and it is only when such exchange has subscribers that the property of the owner invested therein has an earning power. But subscribers are not obtained without expenditure of money, labor and time, during which the capital invested in the plant earns nothing and often fails to pay operating expenses.

"During the term of development there is a loss of money actually expended and of dividends upon the property invested. How shall this be taken care of? Must it be borne by the owner of the plant? Or by the initial customers? Or shall it be treated as part of the investment or value of the plant, constituting the basis upon which charges shall be made to all customers who receive the benefits from the increased service-rendering power of the plant by reason of these expenditures? It seems that the last solution is the original, just and correct one. If rates were to be charged from the beginning so as to cover these expenditures and earn a dividend from the time a plant is first operated, the rate to the first customers would be in many instances, if not in all, so exhorbitant as to be prohibitive and would be so at the time when the plant could be of least service to them. On the other hand, the public cannot expect as a business proposition or demand as a legal right that this loss shall be borne by him who furnishes the service, for, investors in public service property make such investments for the return they will yield; and, if the law requires that a portion of the investment shall never yield any return, but shall be a total loss to the investor, capital would unwillingly be placed into such classes of investments; but the law, in our opinion, does not so require. Private property can no more be taken in this method for public use without compensation, than by any other method. When the use of the property and the expenditures made during the non-expense paying and non-dividend paying period of the plant are treated as an element of the value of the property upon which fair returns shall be allowed, then the burden is distributed among those who receive the benefits of the expenditures and the use of the property in its enhanced value."

Applying this ruling to the case before it, the Court added a sum equal to twenty per cent of the value of the physical property of the Company as a "going concern" value.

Upon the question of depreciation the Commission held that a sufficient allowance for current maintenance would be sufficient, while the company contended that there must be created a depreciation reserve fund to take care of depreciation which could not be taken care of by current maintenance repair and that this fund should be taken from the gross earnings of the Company. The Supreme Court approved of the position of the company in this question, saying, among other things:

"All the evidence is to the effect that there is at all times going on in a plant of this character a depreciation that cannot be overcome by repair. It is rare that any physical property impaired by time and use can be so repaired as to be the equivalent of the same property new. There comes a time in the life of physical units when they cannot be made usable by repair, and they must be discarded and replaced by new properties which requires the expenditure of capital."

Upon the question of the rate of return the court follows the ruling of the United States Supreme Court in the Consolidated Gas Company case, and while it does not undertake to say what is a reasonable rate of return, it does say practically that the legal rate of interest allowed by the laws of the state would be the minimum rate of return, and that the maximum rate of return would depend upon the character and location of the enterprise, intimating that such a maximum would be higher in the cities and State of Oklahoma than it would be in the most settled part of the country.

Independent Telephone Companies May Unite.

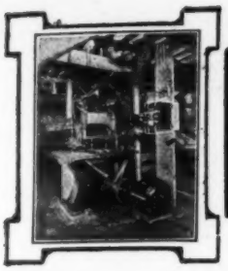
According to recent reports the independent telephone companies in the United States may be combined into an immense system which will rival the American Telephone & Telegraph Company in extent. J. P. Morgan & Company are at the head of the movement.

Tentative propositions from the Morgan house are under consideration by the leading local and long-distance companies operating between the Hudson River and Denver, and a definite proposition will be submitted to investors interested on February 1.

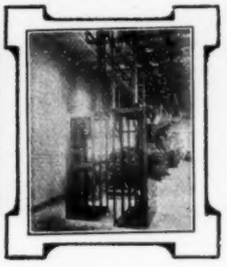
Negotiations have already been opened with the Kinloch Telephone Company, of St. Louis, Kansas City Home Telephone Company, Joplin Home Telephone Company and long-distance companies of New York, Pennsylvania, Ohio, Michigan, Wisconsin, Indiana, Illinois, Missouri, Kansas and Colorado. The idea of consolidation includes the operation of a trunk line from northern New York to Denver via St. Louis, Kansas City and Omaha.

Antenna for Flying Machine.

In Farman's experiments on radio-telegraphy from his flying machine, he uses as antennæ two fine wires which trail behind the aeroplane for 200 yards, being supported only at one end.



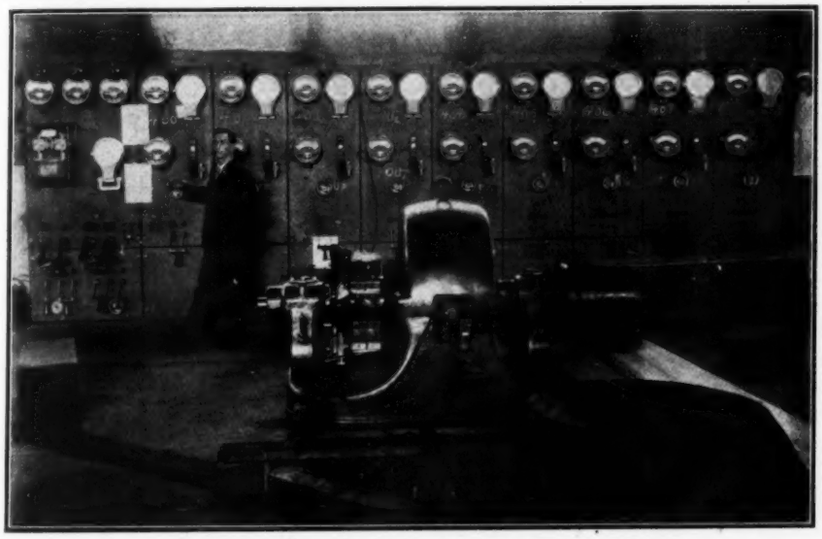
Industrial Power



A NOVEL POWER PLANT.

BY C. V. HULL.

The Hart-Parr Company, Charles City, Iowa, manufacturer of gas tractors, has recently added a new power house to its plant. In this plant the company continues its policy of generating power with the engines while they are being tested. The forty-five horse-power tractor is the one referred to in this article, though both thirty and eighty-horse-power engines are tested in the same manner. While being run in the belt in the power house, test cards are made on the wattmeters and the power used throughout the plant is generated.



SWITCHBOARD IN HART-PARR POWER PLANT.

The test is carried on in the following manner: When finished by the erecting department the engine is reported to the power and testing department. As soon as properly adjusted the engine is run to the yard where the traction gear is thoroughly tested. The engine then goes to the power house, where it passes the belt test for actual horsepower. After a few hours' run on the belt the test card is made by running the engine with a thirty kilowatt showing at the wattmeter. The generator belted to the engine is cut in on the line during the entire time that the engine is being tested in the belt. Thus power is generated to advantage for as soon as one engine is tested another takes its place and assists in power and light generation.

The dynamos are of various types of forty and fifty kilowatts capacity. All are run shunt wound, without making any effort to use the compounding. This is done that each machine may be easily put in or taken out of service and to save any complication at the switchboard. The voltage varies from 220 to 250 volts under ordinary conditions.

Two generators of twenty-five-kilowatts capacity are direct connected for a balance set and have been in continuous service nearly a year.

The advantage of the shunt-wound machines is evident when changing engines. The tested engine is cut out, unblocked, unbelted and run out on its own power. The tested engine then goes out for shipment and an untested engine is run in, belted, blocked, and cut in on the load with a small load until it is warmed up and adjusted. Then more load is added until the engine seems to be in condition for the full load test. It is evident that it would be rather difficult to do this with compound machines and equalizer.

The switchboard recently installed consists of nine panels for engines and one distributing and balancer panel. It was furnished by the F. Adams Company and put in under the direction of the company. It is made of blue slate and all parts are back connected. Each generator panel has one switch for cutting in on the busbars, one rheostat handle, one Weston voltmeter, one Weston ammeter, one Bristol (30 to 70 kilowatt) wattmeter, one circuit-breaker and one pilot lamp.

The distributing panel has one Thompson integrating meter, one Bristol recording wattmeter, one power and one lighting switch on the upper part. The lower part has switches for two balancer sets, each set having one field switch, one switch for the line, and one for cutting out the starting rheostat and cutting in the neutral. The field switch for the direct-connected set is, however, on No. 400 panel and is tied in because some trouble was experienced on account of inexperienced men pulling it before the main switches were pulled. The two plates and handle shown at the bottom are for starting rheostats for the balancers. These have not as yet been installed and a large rheostat, not shown, is used for both balancers.

It will be noted that the engines are generating current during the entire belt test, the shunted dynamos allowing the load to be divided as best suits the engines. The simple switchboard makes it easy to handle. The printed instructions for the board are seen just at the left of the main-line wattmeter. Any engine can be very quickly taken out of service. The cards on the wattmeters seldom show more than a ten-minute period for changing engines. The test card or chart must show over thirty kilowatts for one hour. The cards or rather charts are changed

every morning at 7:30, and every time an engine is changed. Thus there is a complete record of the performance of each engine during the belt test. These cards are filed with all other data referring to the particular engine.

One of the dynamos is hung on a frame designed for the purpose so that it may be connected to a dead load and used at the same time as dynamometer. This machine is used for special testing, as the instrument and beam readings may be taken and a double check had by reference to the efficiency curve.

Rothesay Dock Installation—Electric vs. Hydraulic Machinery.

For the past three years there has been operating at the Rothesay Dock on the River Clyde, for the Clyde Navigation Trustees, a complete electric dock equipment, and a valuable account of the experience obtained with this installation has been given before the Institution of Mechanical Engineers in London (January 20). The appliances already erected consist of 2 thirty-two-ton coal hoists; 18 four-ton cranes; 27 one-ton capstans; 2 eighteen-foot tipping turntables; 2 five-ton pierhead capstans; an underground distribution system, and an electric lighting installation. The undertaking has its own generating station equipped with two 450-brake-horsepower high-speed triple-expansion engines driving continuous-current generators; a third like set is now erecting, and there is a 120-kilowatt light-load set. Two further thirty-two ton coal hoists and turntables, two 4.5-ton transporters, three four-ton cranes and twelve capstans are now being added.

The relative positions of electric and hydraulic power for the operation of dock equipments, viewed in the light of three years' working of the foregoing installation at Rothesay Dock, are described as follows by Walter Dixon and George H. Baxter, the authors, who carried out the scheme for the trustees:

First, as to reliability, which is the keynote of all dock machinery, it is stated that at Rothesay Dock, where electric power alone is available and where coal hoists, cranes, capstans, turntables and other machinery are in constant operation, no stoppage due to electrical causes has occurred to interrupt the regular working of the dock. The various docks on the Clyde being tidal, dock-gates and sluices are not required, but the successful application of electrical power to swing and rolling lift (Scherzer) types of bridges, the uninterrupted working of which is essential, clearly demonstrates the reliability of electric power for such work. If any additional testimony to the mechanical strength and reliability of electrical plant is required, it is to be found in the many thousands of horsepower installed to operate rolling mills, than the demands of which nothing can be more severe.

In respect of economy it is admitted that where cranes are working under ideal conditions for hydraulic power—that is at full load—there is nothing to choose between the systems, but as the conditions are rarely or never met with in actual working, the advantage is with electric cranes. Electric coal-hoists have been shown to be more economical than hydraulic hoists, and electric capstans much more so.

Next, as to adaptation, it has been suggested that in order to secure the advantage of adopting the power best suited to the appliance operated, a dock might be equipped with a combination of both forms of power, but obviously such a compromise has many objections, and it would appear quite unnecessary since electric power has now been proved to be quite reliable and economical for working all dock appliances, a feature not possessed by hydraulic power. This, together with the fact that the current for lighting is also produced by the electric plant, results in a better load factor and a consequent reduction in generating cost.

Respecting storage of energy, it has always been charged against electric power that the system possesses no equivalent to the hydraulic accumulator, the main function of which is to equalize the demands upon the power station so that a comparatively small prime-mover may be employed. The plant at Rothesay Dock consists of an entirely new combination arranged by Messrs. Dixon and Baxter for the first time, in which an engine of 450-horsepower normal rated output supplies power for an aggregate of 936 horsepower in the generators, which power is utilized for all requirements of power and lighting.

It is difficult to form a comparison as to cost of generating station plant, as the design and equipment of each station has to be arranged to suit local and other conditions. It is probable, however, that there need be no appreciable difference in the capital cost of an electric and hydraulic station when fully equipped for the complete dock installation of power and lighting.

The initial capital expenditure for the distribution system is probably about the same. Whatever the life of hydraulic pipes may be, that of an electric system as installed at Rothesay Dock will be as long, and the scrap value considerably more. The risk of fire with hydraulics is, of course, nonexistent, with a properly installed electric system it may also be regarded as practically so.

Messrs. Dixon and Baxter submit that by the Rothesay entirely electrically equipped dock they have shown that apart from the admitted advantages of electric power, the relative positions of electric and hydraulic power are now: (1) Electric and hydraulic systems are equally reliable. (2) The cost of working with electric and hydraulic power is equal at full load, but under variable and low conditions electric power is cheaper. (3) Electric power has now the equivalent of the hydraulic accumulator. (4) Electric power can be applied to all dock appliances, and has greater flexibility than hydraulic power.

Facilities for Extending Foreign Trade.

The Bureau of Manufactures, Department of Commerce and Labor, Washington, D. C., is establishing a file of the names of American manufacturers and traders, for use in distributing information which reaches it from time to time in regard to foreign trade. Those who desire to avail themselves of the facilities thus offered for extending their trade abroad should send to the bureau their names and advise it as to the class of business in which they are engaged.

Coal Production of the United States.

The total coal production of the country is in round numbers about 75,000,000 long tons per annum of anthracite, and approximately 350,000,000 tons of bituminous, the estimated value at the mines being, of anthracite about $160,000,000, and of bituminous approximately $400,000,000.

Illinois Electric Railways Association.

In order that steps might be taken toward the organization of a permanent society for the good of the electric-railway interests of Illinois, representatives of various interurban railroads in the state met on January 19, at the Great Northern Hotel, Chicago. About thirty men were present, representing twenty interurban railway companies.

The present meeting was in furtherance of a meeting called some time ago. At this preliminary meeting circulars were sent out to the various roads and their interest was as far as possible stimulated in this way. These facts were mentioned in a preliminary talk made by G. W. Quackenbush, who acted as chairman, and through whose efforts the meeting was brought about. There had, he stated, been a former association of this nature, which was organized about six years ago, and which was later dissolved. The members of that body were as follows: Joliet & Southern Traction, Illinois Traction, Aurora, Elgin & Chicago Railroad, Bloomington & Pontiac, Elgin & Belvidere Electric, Chicago, Aurora & De Kalb, De Kalb & Sycamore and Chicago & Milwaukee Electric Railway companies.

The original society was in the nature of a clearing house for mileage books, and seemed on the whole to have been quite successful during its life.

The members present at the organization meeting of the society were invited by letters which were decided on at a former meeting, and which stated the need for and the aims of such an organization.

Following the reading of the minutes of the preliminary meeting several talks were given relative to the proposed work of the body.

C. D. Emmons, of the Central Electric Railway Association, spoke regarding the history of his Association and the manner in which the present organization was formed from societies of a similar nature in Michigan, Indiana, Ohio and Kentucky, which states are now included. There are at present fifty-two member companies, and each of the meetings has from 125 to 150 members in attendance. Mr. Emmons dwelt on the advantages of the larger Association and invited the new Illinois body to join it and share the advantages of its wider field. The members would obtain great benefits both from a business standpoint and because of the broader view secured in this way.

F. I. Hardy, who also represented the Central Electric Railway Association, spoke further of the advantages gained as regarding traffic. In the field of the Central Electric Railway Association agents sell through tickets, and in many cases send through cars over the allied roads, which are advantages that should not be overlooked.

Consideration of the matter of joining forces with the Central Electric Railway Association was also urged by A. A. Anderson, general manager of the Springfield Consolidated Railway Company, who made a motion that a committee be appointed to confer with a similar committee from the Central Association.

In order that the organization might be made more definite, temporary officers were named, who were announced by J. R. Blackhall, chairman of the nominating committee to be H. E. Chubbuck, president, and C. E. Flenner, secretary. Owing to Mr. Chubbuck's absence, Mr. Quackenbush was made president *pro tem.*

Other committees named were as follows: Executive Committee, A. E. Faber, A. A. Anderson, C. F. Handshy, M. E. Sampsell and J. R. Blackhall; Committee on Constitution and By-Laws, G. W. Quackenbush, L. D. Fisher and T. F. Grover. A committee of three was also appointed for the purpose of conferring with a committee from the Central Electric Railway Association regarding the matter of affiliating with that body. Members of this committee are: H. J. Vance, C. H. Cox and B. E. Merwin.

A committee composed of Messrs. Hewitt, Sampsell and Handshy conferred for the purpose of finding a suitable name for the Association and decided that it should be called the Illinois Electric Railways Association.

A meeting will be held on Friday, February 17, at the Great Northern Hotel, for the purpose of organizing a permanent body.

Exports of Copper.

Exports of copper for the week ending January 19 amounted to 7,494 tons. Since the first of the month the figure given is 20,995 tons, as compared with 16,405 tons for last year.

Wood Preservers' Association.

The seventh annual convention of the Wood Preservers' Association was held at the Auditorium Hotel, Chicago, on January 17, 18 and 19. The meetings were well attended and an interesting program of papers was presented and discussed. These related chiefly to the preservative treatment of timbers for railroad ties.

Among these papers were the following: "Is the Covering of Retorts Economical and Practical," by R. W. Yarbrough; "Difficulties Encountered in the North That Plants Located in the South Do Not Have to Contend With," by Andrew Gibson; "Should Sawn and Hewn Ties of the Same Kind of Timber and of the Same Degree of Seasoning Be Treated In the Same Cylinder Load," by H. J. Whitmore; "Piling of Timber," by J. H. Waterman; "On the Feasibility of Grouping Timbers for Treatment," by W. F. Goltra; two papers on "What Penetrations Are to Be Expected With the Different Amounts of Preservative Usually Specified," by David Allerton and by R. L. Allardyce; "Some Results Obtained in This Country in Prolonging the Life of Railway Cross-Ties by Preservative Treatment, as Shown by the Records That Have Been Kept—A Better Method of Keeping These Records," by F. J. Angier; "Treating Ties Along the South Atlantic Coast," by William A. Fisher; "Wood Supply in Relation to Timber Preservation," by E. A. Sterling; "General Review of Timber Treating in This Country With Special Reference to Causes That Have and Are Retarding Its More Universal Adoption," by J. T. Logan; "What Per Cent of Creosote Oil Can Be Withdrawn From Wood, by Subsequent Vacuum," by C. D. Chanute; "Asphaltic Oils as Applied to the Treatment of Railroad Ties," by F. W. Cherrington.

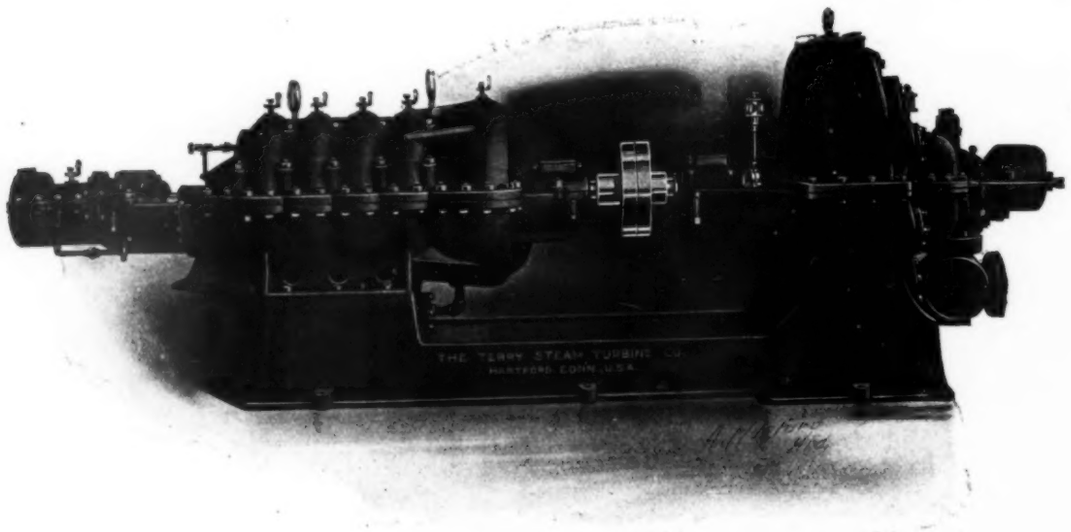
Electrical Exposition at Chattanooga, Tenn.

On the completion of the plant of the Eastern Tennessee Power Company at Hale's Bar on the Tennessee River, and the one at Parkersville on the Ocoee River, an electric celebration will be held at Chattanooga. The exposition will include a brilliant lighting of the streets and electrically operated machinery is also to be shown.

New Electrical and Mechanical Apparatus and Appliances.

Turbine-Driven Centrifugal Pumps in Power House.

A pumping apparatus which is finding an increased number of uses is the centrifugal pump direct connected to a steam turbine. The compactness of such an installation is shown in the accompanying illustration of a centrifugal pump direct connected to a Terry steam turbine and mounted on a common base. These units are manufactured by the Terry Steam Turbine Company, Hartford, Conn.



TURBINE-DRIVEN CENTRIFUGAL PUMP.

Space considerations are often of the highest importance in the power house and the compactness of the turbine-driven centrifugal is an added argument in its favor, and the fact that high rate speeds and consequently smaller sizes may be used in many cases gives it a great advantage.

The thermal efficiency of the turbine as a prime mover compares favorably with the reciprocating engine, but this feature is rarely of importance because of the extensive use of exhaust steam from auxiliaries for heating the feed water. As compared with the reciprocating outfit, the exhaust steam from the turbine may be used in an open heater without danger of carrying oil over to the boilers, whereas with reciprocating units it is generally considered more advisable to use them with closed heaters or else to throw away the exhaust steam entirely.

Where large condensing units are employed and the basement space is limited, the small dimensions of the turbine-driven pump enable it to be placed in almost any available place, very often directly under the condenser itself. This is, of course, particularly true of hot-well pumps, but in many cases the circulating pumps have also been arranged in this fashion.

Although the field for these units in power house design is very broad, there are two main uses to which they are particularly applicable—in connection with condensers and for boiler feeding. For circulating the water for a surface condenser the pump should be able to handle large quantities of water at comparatively low head and medium speeds. The large capacity of a turbine-driven centrifugal and its small size are important advantages for this class of service. The operation is in general steady, as the rate of flow of the condensing water is never altered, regardless of the load on the main unit. A steam turbine with its close regulation is well adapted to run satisfactorily under this steady load with practically no attention whatsoever beyond occasional oiling.

Centrifugal wet-vacuum pumps are becoming much more common of late, since the troubles which cropped out in the first installations of this character have been practically remedied. If a sufficient suction head is available on a pump, say three or four feet, care is taken to insure tightness, and a discharge head of twenty-five to thirty feet is provided, these units will operate satisfactorily under all conditions of load. The rapid fluctuations often experienced on the main units of a central station cause very rapid changes in the total water rate and consequent speeding up and slowing down of the wet-vacuum pump. The flexibility of the direct turbine-driven centrifugal is of vast importance in such cases.

In the accompanying illustration is shown a five-stage centrifugal pump manufactured by the Platt Iron Works, for boiler feed purposes, direct connected to a Terry steam turbine. This particular unit is one of eight installed in a large power house in which there are no reciprocating boiler feed pumps at all, reliance having been placed entirely on the newer type.

The use of centrifugal pumps for feeding boilers is growing rapidly in favor, high pressures being obtained by the multiplication of stages and capacity by high speeds. Pressures up to 270 pounds have been handled by five-stage pumps with a capacity of

anywhere from 500 to 1,500 gallons per minute. Both turbine and pump being so simple in design, wearing parts are reduced to a minimum and the cost for repairs, oiling and attendance consequently very much diminished.

The centrifugal pump is now accept-

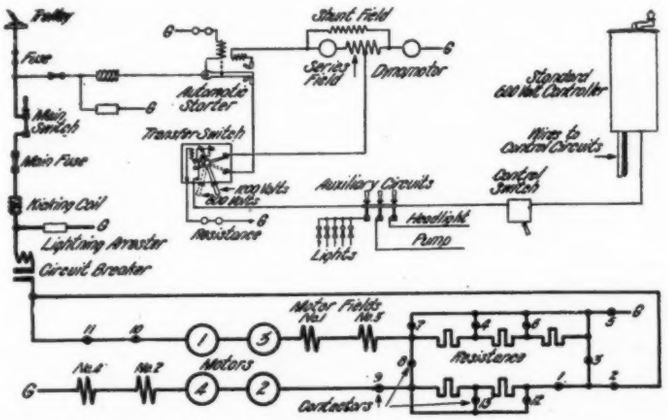


FIG. 3.—DIAGRAM OF TRANSFORMER CONNECTIONS.

ed as a standard design for fire pumps, many large installations of this character having been made within the last few years. Fire service is always emergency service and this means ability to start up quickly at any time. When the pump is properly primed—a very simple matter to provide for—it is only necessary to open the throttle valve of the turbine to get results. To obtain full rated pressure and capacity it is merely a question of getting up to rated speed.

Various methods of priming the pumps are in use and the popular method in power-plant practice is to place a foot valve on the end of an intake pipe, this insuring the pump being floated when it is desired to start up.

Switchboards for Japan.

Two switchboards of considerable size have lately been built by the General Electric Company, Schenectady, N. Y., for the Kyoto Municipal Water Works, Japan.

The generating station board is shown in Fig. 1. It is forty feet long and consists of twenty-four three-section marble panels, supported on a pipe framework. This framework also carries the oil switches, disconnecting switches, instrument transformers and several sets of busses.

The station equipment controlled from this board consists of two 125-volt, 125-kilowatt turbo-generators; five three-phase, 6,600-volt, 1,500-kilowatt, sixty-cycle turbo-generators; three 6,600-volt, three-phase outgoing lines to substation; one bank of 6,600/3,500-volt transformers; seven three-phase, 4,500-volt feeders; and three three-phase, four-wire, 3,500-volt feeders.

Each exciter has a triple-pole, double-throw switch and a double set of busses so arranged that either exciter can be used to excite the generator fields, while the other is used for station lighting and auxiliary power.

The alternating-current generator panels, in additon to the usual instrument and synchronizing equipment, have reverse-current relays for automatically tripping the oil switches on a reversal of current which might result from a short circuit in the winding of the generator or from a failure of the prime mover.

The panels controlling the different lines and feeder circuits are equipped with inverse time limit overload relays in connection with automatic oil switches in addition to the indicating instruments.

Continuity of service was considered of primary importance in the design of this switchboard, and to insure this an arrangement of spare equipment, as illustrated in Fig. 3, was adopted. For the transformer bank, consisting of three 750-kilowatt single-phase units, one spare transformer of the same capacity was installed to take the place of any disabled unit. These four transformers are connected through transfer switches on the primary and secondary sides to enable the operator to disconnect any unit and connect the spare for service in the shortest possible time.

Spare oil switches for both the three-phase, three-wire and the three-phase, four-wire feeder systems connects the main feeder bus with a set of emergency busses to which any feeder circuit can be connected through transfer switches. The feeder oil switches are provided with disconnecting switches on each side and can be taken out of service for inspection and cleaning without interrupting the service of the circuit.

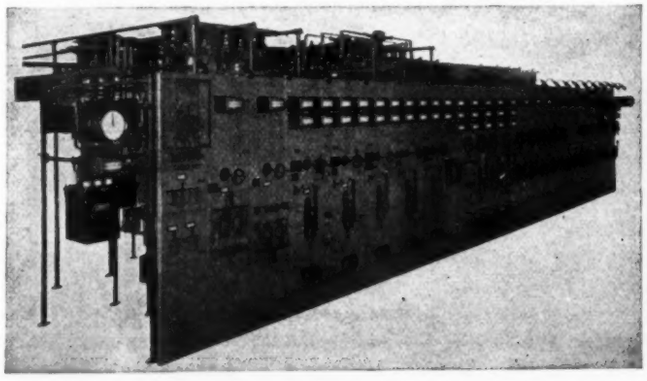


FIG. 1.—SWITCHBOARD FOR MUNICIPAL WATER WORKS, JAPAN.

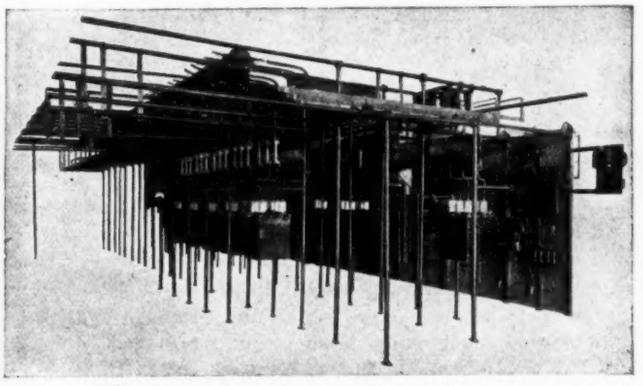


FIG. 2.—ARRANGEMENT OF SWITCHING APPARATUS.

New Type of Oil Switch.

Allis-Chalmers Company has recently brought out a new type of oil switch designed for either switchboard or wall mounting, for pressures of 3,300 volts and under, and in capacities up to and including 600 amperes. They are furnished with or without automatic tripping features, as may be desired. These switches are of the vertical up-break type, a construction which the company has found very desirable because of the fact that maximum depth of oil is secured at the point of rupture of the circuit.

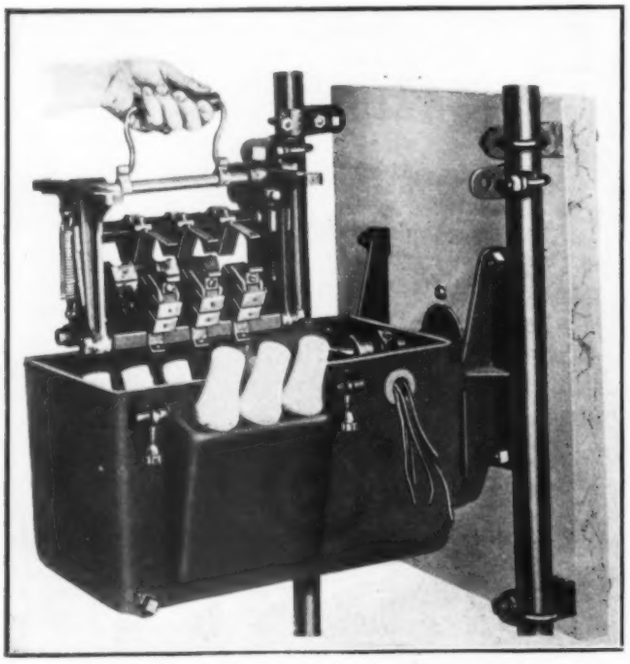
The construction of the whole apparatus is very simple, durable and compact. The oil tank is made of cast iron and constitutes the main frame of the switch. It has a cast-iron cover, which is held in place by hinged bolts and thumb screws and which holds a felt packing ring tightly in place, so that practically no dust can get in or oil escape from the case. The level of the oil in the case is shown by an indicator on the outside and provision is made for drawing off the oil by means of a drain pipe.

The working parts of the switch, including the stationary and bridging contacts, are made in a unit, which is conveniently removable from the tank without disturbing the leads or connections. This is shown in one of the accompanying photographs. An interlock is provided so that the switch unit cannot be removed from, or inserted in, the tank unless the contacts are in the "open" position. The contacts are so arranged that a rubbing action takes place when they are brought together, tending to keep them clean and to squeeze out the film of oil between them. Auxiliary removable arcing contacts are provided which break after the main contacts have spread approximately one-quarter of an inch.

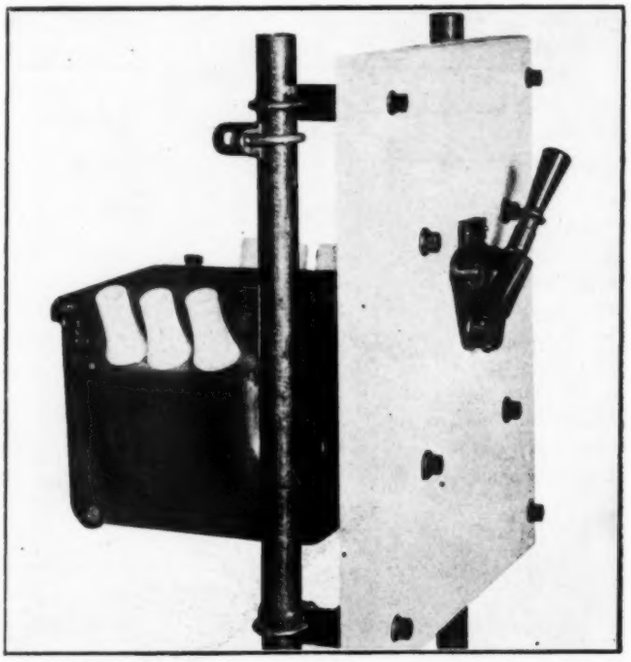
When the automatic tripping feature is applied, three tripping coils, for the three-pole automatic switch, are arranged for connection to three series transformers which are furnished with the switch. This construction affords absolute protection under all circumstances. The two-pole switches are provided with one series transformer and the four-pole switch with two. The tripping mechanism is rugged in construction and at the same time sensitive to overload conditions and positive in its action. The switches are calibrated for from 80 to 160 per cent of the rated current of the switch.

Allis-Chalmers Company claims many advantages for this switch over the usual type, some of which are as follows: The switch unit can be removed and taken to an adjacent bench, where a thorough inspection and all necessary adjustments can be made with good light. The switch units of any one size are absolutely interchangeable, so that an extra switch unit can be placed in the case while one which has been in operation is removed, if this procedure is desirable.

With these oil switches the arc is drawn at a point of greater depth of oil than the usual construction permits. This avoids a common fault of throwing oil when the switch is open under a heavy overload or short circuit and affords a greater breaking capacity with less disturbance. The tripping coils and automatic features of the switch are entirely enclosed and protected within the case, while at the same time they are easily accessible for inspection.



INTERIOR OF NON-AUTOMATIC OIL SWITCH.



SWITCHBOARD MOUNTING—NON-AUTOMATIC OIL SWITCH.

Incandescent Lamps Exported from Austria-Hungary.

A report from Consul General Charles Denby, at Vienna, states that in 1909 Austria-Hungary exported 20,000,000 incandescent lamps, worth $816,343, over half going to Germany and European Russia, other principal destinations being Italy, Great Britain, France, Mexico, Argentina, Roumania, and Holland.

The total amount of shipments to Germany, including Hamburg and Bremen, exceeded $260,000 worth, the Russian demand amounting to approximately $170,834.

A New Section Insulator.

To meet the demand for a sturdy trolley-line section insulator, so constructed that all of its wearing parts can be readily renewed, the Westinghouse Electric & Manufacturing Company has developed a new form which will be known as the type "KB." It is apparent from Fig. 1 that very rugged construction has been adopted. On test it is found that No. 4/0 phono-electric wire can be broken "on a jerk" without any sign of failure in any part of the KB insulator.

The tension is taken by two hickory bars, each having a section of 0.88 by 3 inches. Vertical slots are provided in these, as shown in Fig. 1, and projections from the end castings engage in the slots. The stress is thus transmitted to the hickory bars without the bolts assuming any shearing stresses. The bolts serve only to clasp the end castings to the bars.

Sherardized malleable-iron caps inclose the ends of the hickory bars and protect those members against splitting and also from injury from "wild" trolley wheels. The renewal bronze approaches are identical with those used on Westinghouse Detroit frogs. They have sufficient length to be flexible and they effectively prevent wear or crystallization of the trolley wire. When worn out the approaches can be replaced in a few minutes by taking out the two bolts referred to above.

The renewable runner is of fiber and has tips of bronze which take the brunt of the arcing. By removing the two cotter pins shown in Fig. 1 a worn-out runner can be removed and replaced with a new one in a few minutes. Tapered sleeves, shown in Fig. 2, held the trolley wire in the end castings, and the renewable approach serves as an auxiliary holding device. The sleeves are internally threaded and are slotted longitudinally. Before being driven into position they fit the trolley wire with a small clearance and when tapped into the corespondingly tapered conical seats in the end castings, they grip the trolley wire tightly. The sleeve cannot lose its grip when the wire is under tension, but by pulling the slack in the trolley wire toward the section insulator the sleeve is loosened and can be easily removed without cutting wire. The sleeves are furnished for round, grooved or figure-eight trolley wires.

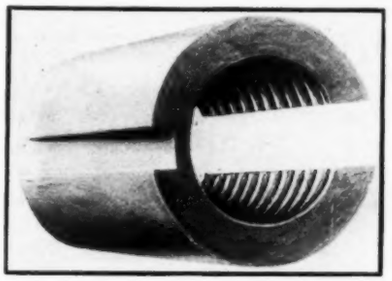


FIG. 2.—VIEW OF TAPERED SLEEVE.

Feeder lugs are provided on the KB section-insulator. One lug is cast in each of the end castings, and a strong steel set-screw is supplied. These lugs may be used for either feeding energy into the adjacent trolley wires or may be used for connecting a jumper around the section insulator. The middle casting is tapped and can be furnished to accommodate a five-eighths-inch or a ¾-inch stud. The middle casting is also formed so that it constitutes a supporting yoke. All metal wearing parts of the KB insulator are of bronze and all other metal parts are of sherardized iron or steel.

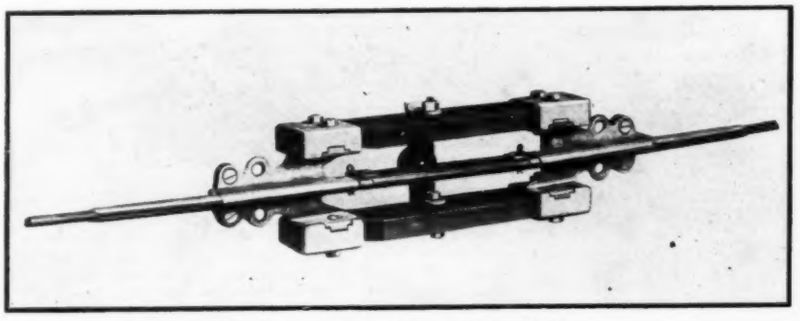


FIG. 1.—NEW SECTION INSULATOR.

Sunray Lamps for Automobile Show.

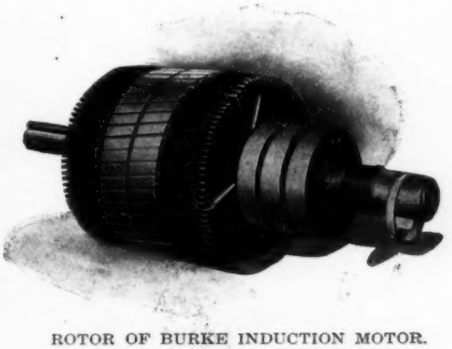
For illuminating Madison Square Garden, during the recent New York Automobile Show, Sunray high-efficiency arc lamps were used, with gratifying results. The conditions governing the selection of lamps for this event were so severe that the Sunray Electric Lamp Manufacturing Company, of New York, manufacturers of the lamps, consider it a significant indorsement of the dependability of Sunray arc lamps.

The quality of light produced by this type of lamp was particularly suitable for the show and the uniform diffusion of light produced a pleasing and restful effect.

The Sunray lamp consumes about one and one-tenth watts per candle and the total maintenance cost is said to be below two-tenths of one per cent per candle for 1,000 hours.

Burke Induction Motors.

Burke induction motors were placed on the market some years ago, and embody the substantial features of the Company's direct-current machines. In most cases they are interchangeable as regards shape and size of bases, shaft extensions, height, etc., so that generally wherever direct-current machines fit, alternating-current machines may be substituted. This is especially advantageous to builders of motor-driven machines, using a motor attached to each machine. A high degree of accuracy has been maintained throughout, thereby resulting in interchangeability of parts, and the assurance that the resulting assembled machine has all parts accurately related to each other and is in accurate alinement.



ROTOR OF BURKE INDUCTION MOTOR.

The stator casing is a rigid iron casting with internal rules. The center of gravity is low, preventing any vibration. All laminations are keyed. The bearings are of cast iron with linings of special babbit metal.

A view of the rotor of one of these motors is shown in one of the accompanying illustrations. It is of rigid con-

struction, having no solder, rivets or bolts to work loose. Each bar is formed from a solid piece and placed in two slots, so that they all overlap.

The air gap provides ample clearance, both the rotor and stationary element being finished to an exact dimension. The pulleys, belt-tighteners, etc., are all of the most approved design.

In one of the accompanying illustrations is shown a Burke induction motor and direct-current generator directly connected and provided with a flywheel to take care of large momentary overloads.

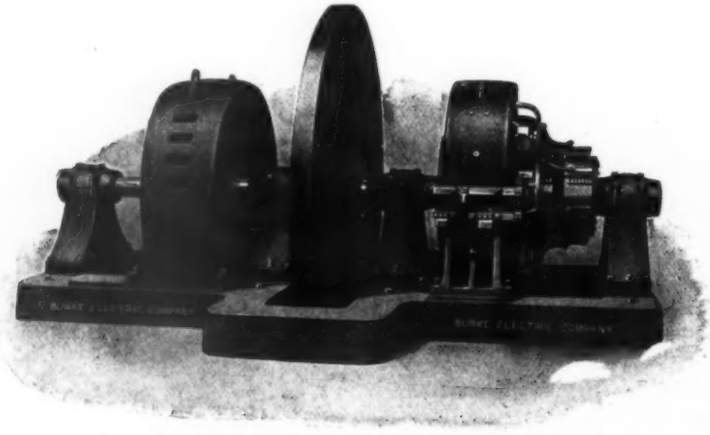
These sets are manufactured by the Burke Electric Company, Erie, Pa.

Telephone Dispatching System on the Evansville & Terre Haute Railway.

The Evansville & Terre Haute Railway has recently equipped its main line from Evansville to Terre Haute, Ind., with a telephone train dispatching circuit consisting of twenty-seven regular way stations, twenty-five siding telephones and twenty-five block telephone stations. The siding telephones have been placed on the block wire. The line has numerous sidings branching out to mines, as well as a number of blind sidings, and traffic is so heavy that a great deal of the local work is handled by the block system.

A system of repeating coils and switches has been installed. It is possible by means of this to connect a branch telephone direct to the train wire in case it is found necessary for a train crew to talk to the dispatcher.

Another interesting feature of this installation is that the block telephone wires are simplexed for telegraph work, thus providing a local telegraph station for message work at each block office. In some cases the local telegraph stations are installed in offices not arranged for block service. To accomplish this a special circuit was furnished by the Western Electric Company, which installed all of the telephone equipment. By the introduction of this simplex arrangement for local message work the officials were able to save on the installation approximately $2,000.



BURKE MOTOR-GENERATOR SET WITH FLYWHEEL.

Lighting Large Areas with Mazda Lamps.

While the special purpose of the Mazda lamp is to afford a unit of low candlepower and high efficiency that by frequent spacing nearer the plane will give an even distribution of light with the elimination of shadows, there is a large and growing demand for the larger units to replace arc lamps at the greater heights, and especially on circuits where power drive at 200 to 250 volts makes this voltage, only, available for lighting circuits.

FIXTURE NO. 2120.

For some time the Wheeler Reflector Company, Boston, Mass., has been placing on the market fixtures adapted to this purpose, three of which are illustrated below.

Wheeler Mazda arc fixture No. 2030 in four lights is adapted for the use of four lamps up to 100 watts in multiple, or four in series on 100 to 130 volts, or in series on 200 to 250 volts. No. 2031 is made for five seventy-five-watt lamps in multiple or five in series on 200 to 250 volts. These will replace alternating-current or direct-current arcs at the average height at which arc lamps are hung.

No. 2080 is made for four 250-watt lamps with large Edison base in series on 200 to 250 volts, and No. 2082 for four 250-watt lamps with standard Edison base in multiple on 100 to 130 volts to replace flaming arc lamps. This is an advantage particularly where the lighting unit must be hung thirty to forty feet high in heavy manufacturing plants to clear moving cranes or in skating rinks, armories or similarly large assembly halls.

No. 2012 is adapted to use in place of arc lamps with 250-watt lamps with a glass globe to protect the lamp from flying chips of steel, and No. 2135 with 400 and 500-watt lamps. The convenience of these large units is apparent in obviating the necessity for frequent trim and in their adaptability to circuits where the expense of rewiring is inadvisable.

FIXTURE NO. 2030.

FIXTURE NO. 2080.

A New Alloy.

A new white alloy called atherium has recently been brought out. It has a specific gravity of 2.4 to 2.57, a tensile strength of 41,800 pounds per square inch, and elastic limit of 33,700 pounds per square inch, and elongation of 17.5 per cent. This light alloy makes second castings, clean screw threads, and can be soldered, forged, welded, rolled and turned. It does not tarnish and withstands sea-water.

Current Electrical News

GREAT BRITAIN.

(Special Correspondence.)

LONDON, JANUARY 14.—The circumstances under which the Westinghouse steam turbines had to be superseded by Parson's turbines at the Lots Road power station, which supplies practically all the underground electric railways in London were divulged for the first time this week. The steam consumption of the turbines was considerably higher than the specification guarantee, and in spite of pulling one of the machines to pieces in 1907, the British Westinghouse Company found itself unable to make any appreciable improvement, and the best result was so far short of the steam consumption figures given by Parson's turbines in actual practice, that I believe the Westinghouse Company agreed with the Underground Electric Railway Company, which owns the Lots Road power station, that it was the prudent course to scrap the whole of the eight Westinghouse turbines, and install Parson's machines.

Serious attention is being given by the London Borough Councils to the question of the London County Council's insistence upon the provision of pressure testing stations, which they are entitled to demand under the terms of the London Electric Lighting franchises. Already two Borough Councils have been threatened with police court prosecutions, and a committee has been formed with the object of relieving Borough Councils owning electricity works from the obligations in this respect which the London supply companies are bound to abide by.

Although Sheffield was the first place in England where an electric furnace was installed, an attempt is being made to develop the industry of steel castings manufactured by electrical processes in the South-east of England. At Braintree, in Essex, a two and one-half ton electric furnace of the Heroult type has been erected, the motive power for which is supplied by a generator driven from a producer gas plant, which includes a Westinghouse eight-cylinder vertical gas engine, the cylinders being arranged in tandem. Single-phase current at 110 volts, and twenty-five cycles, is supplied for driving the plant, and there are hopes that a new industry will be developed in this part of the country.

Considerable progress is being made with the only incomplete railway in the London district, which is intended for electric traction. The line in question is being constructed by the London and North Western Railway Company, and is intended to run from its terminus in London, at Euston, to Watford, a distance of about fifteen miles. The object of the line is to relieve the main line on this section of the railway of the purely local traffic, and by improving the service to develop the important residential district in that area. With the exception of a very short length, all the track will be in the open, and the line differs from all other electric railways in this country to the extent that new track is being laid throughout, and that it is not a steam railway converted to electric traction.

The Glasgow corporation seems determined to agitate against the present system of charging for telephone service on the message rate system. A conference is to be called very shortly to impress upon the Government the desirability of a Parliamentary inquiry to revise the existing system of tariffs before the Government takes over the whole of the telephones of the country next year. The old charge of $85 per annum for unlimited use, is being retained in respect of old subscribers, but is not allowed to any new ones. On the other hand, the message rate system of charging to an ordinary business firm making fair use of the telephone has been calculated to work out very considerably more than the unlimited service rate which the National Telephone Company has apparently found remunerative in the past. G.

EASTERN CANADA.

(Special Correspondence.)

OTTAWA, ONT., JANUARY 21.—The city of Sherbrooke, Que., proposes to raise the sum of $100,000 for the development of power by the issue of four and one-half-per cent bonds, redeemable in twenty-five years.

The Toronto Street Railway directors are considering the advisability of issuing another million dollars' worth of common stock, for the purposes of expansion, at par apportioned at the rate of one share in eight to shareholders.

The Sao Paulo Tramway, Light & Power Company is creating an issue of five-per-cent perpetual consolidated debenture stock, limited to an amount not exceeding the paid-up capital of the Company. The Company proposes to offer, at first, about $1,500,000 of its debenture stock in England at a convenient date.

The completed statistics of street railway traffic, in Toronto, for 1910, show a considerable increase in the total receipts over those of the year previous, and a corresponding increase in the City's percentage of the gross revenue. The City received $679,337. In December of 1910, the amount received by the City from the passenger traffic, was almost exactly twice the amount received in December, 1905.

American and English capital has been interested in the establishment of an electric smelting plant at Chats Falls, on the Ottawa River, about eighteen miles west of this city, and active work preparatory to the erection of the plant will begin in the early spring. The surrounding country, on the Quebec side of the river, is rich in iron ore, the only difficulty being that of transportation. It is proposed to build an electric line from the falls to the mines. There is an enormous amount of water power awaiting development at Chats Falls, and the spot is regarded as almost ideal for electric smelting purposes.

Work on the proposed power plant at Waddington, will be commenced early in the coming spring. The electrical machinery, water wheels, and other machinery necessary for the equipment of the plant has been contracted for. By next fall it is expected that between 10,000 and 12,000 horsepower will be available, and that practically all of this amount of power will be taken at once. In the following summer the power development facilities will be doubled, and the expansion work will be continued by the New York & Ontario Company. This is the source of power which, it is said, the Ontario Hydro-Electric Power Commission depends for its supply for Eastern Ontario.

So far as Canada is concerned, the general inclination appears to be to confine the electric railway to city and suburban services. This may be why, compared with the steam railways, the progress of the electric roads seems slow. In 1902 there were 557 miles of electric road in Canada, and 1,047 in 1910. Though Canada offers many advantages in the way of water powers for the electric railway operator, the increase in eight years is but 490 miles, while in the case of the leading steam railway system, it was in the same time, 6,017 miles. By provinces, Ontario leads with some 600 miles of electric road; Quebec is second with 203 miles, of which 125 miles are on the island of Montreal. British Columbia, however, has the longest system (100 miles) under one corporate ownership. W.

MEXICO.

(Special Correspondence.)

MEXICO CITY, MEX., JANUARY 21, 1911.—The report of the Mexican Light and Power Company for eleven months of 1910 shows that its gross earnings during that period were $6,498,048 Mexican currency. The operating expenses were $1,870,094, leaving net earnings of $4,627,954, which was an increase in net earnings amounting to $2,024,032, as compared with the same period of the previous year. In the absence of an official report it is estimated that the returns for the month of December will bring the net earnings for the year up to more than $5,000,000 Mexican currency, which is equivalent to $2,500,000 gold.

The Chapala Hydro-Electric and Irrigation Company has met with unexpected delays and difficulties in the construction of its plant and electric transmission lines to the town and mining district of Hostotipaquillo, Guadalajara, and it is stated that it will probably be the latter part of February before a regular power service is inaugurated. One of the largest mining concerns that has contracted for the power in the Hostotipaquillo district is the El Favor Mining Company, whose extensive property is situated sixteen kilometers west of the town of Hostotipaquillo.

The Guanajuato Light and Power Company is installing an electric lighting system at Leon. This company has an extensive system of transmission lines which extend to various points in the state from its hydroelectric plants in the El Dura section.

According to recent reports all concessions and right-of-way for the proposed electric power transmission line that is to be constructed to the mining district of El Tigre, Sonora, from the power plant of the Copper Queen Company at Douglas, Ariz., have been obtained and rapid progress will be made with the work of erecting the towers and stringing the wires as soon as it is started. The line will be sixty-six miles long, will have a capacity of 44,000 volts and with substations included will cost aboht $150,000. D.

COMMISSION NEWS FROM NEW JERSEY.

(Special Correspondence.)

The Board of Public Utility Commissioners for the State of New Jersey has filed a memorandum indicating the difference in the policy of the State relating to the issuance, sale and delivery of capital stock of corporations in general, formed under the pro-

visions of "An Act Concerning Corporations, Revision of 1896." Among other things the Board holds that the stock of a public utility company shall not be issued, sold or delivered except for cash, of a like or greater amount than the par value of the stock issued therefor, or for property of at least the actual cash value of the amount of stock at par value issued in payment thereof, and further, that the stock must be approved by the Board.

The municipalities of the State, under powers conferred by the Legislature, have adopted ordinances requiring the payment of a license fee for each street railway car operated. They have issued license certificates evidencing the payment of the fee, and have required the placing of the certificates in a conspicuous place in the cars licensed. There is now a question before the Commission as to whether the un-uniformed inspectors shall be permitted to ride free or not.

A complaint has been made against the Union Transportation Company that discrimination in the matter of freight rates has been made between the localities of Cookstown and Wrightstown. The complaint states that the rates from Cookstown to Camden is higher than should be in comparison with the rates from Wrightstown to Camden. As the demand for a readjustment of rates seemed unreasonable, the Board dismissed the complaint. A complaint by the City of Hoboken against the Public Service Railway Company, based upon the transfer system in force on the Grove and Washington Street lines, was also dismissed.

COMMISSION NEWS FROM NEW YORK.

(Special Correspondence.)

Attorney William L. Clark, of New York City, appeared recently before the Commission on the applications of the Elmira Water, Light and Railroad Company to issue $336,000 five-per-cent fifty-year bonds, and the Lockport Light, Heat and Power Company for authority to issue $72,000 in thirty-year five-per-cent bonds under a refunding mortgage. Thomas W. Simmons, a dealer in bonds, testified concerning the probable selling price of both issues, and Secretary H. M. Beardsley gave evidence concerning details of expenditures of the Elmira company. On both matters the Commission reserved decision.

The Commission has also authorized the Ithaca-Auburn Power Company to execute and issue a first-lien trust mortgage upon all its property and rights acquired and to be acquired, to secure the payment of its thirty-year five-per-cent bonds to the amount of $750,000, and to issue its common capital stock for cash at not less than the par value of $50,000. The company is authorized to issue presently bonds to the amount of $433,000 to be sold at not less than eighty-five and the proceeds used for the acquisition of certain property from H. C. Mandeville, of Ithaca, for $100,000; the acquisition of material for the construction and installation of an additional steam plant, $95,000; for the construction of its distribution line and third-rail system for the New York, Auburn & Lansing Railroad Company, $201,000. None of the stock or bonds are to be issued until certain agreements with H. C. Mandeville, the Remington Salt Company and the Ithaca Street Railway Company have been entered into and satisfactory proofs submitted to the Commission.

The Public Service Commission has notified all telephone corporations within its jurisdiction that the practice of offering trial service installations is regarded by the Commission as unlawful, and that the company engaging the same is subject to the forfeiture and penalties prescribed by the Public Service Commission law. It has been brought to the attention of the Commission that certain telephone corporations have heretofore been in the habit of making what is called trial service installations and now it is desired that such installations be discontinued. The Commission calls attention to the requirement of the Public Service Commissions Law that no telegraph corporation or telephone corporation subject to the provisions of law shall directly or indirectly give any free or reduced service except in certain cases as specified.

The Commission has received a complaint from Major General F. D. Grant, commanding Department of the East, U. S. A., asking the Commission to require the New York Telephone Company to furnish trunk line service to be connected with the Post Telephone switchboard installed by the Government. General Grant states that the Company has heretofore declined to grant the connection with such service on the ground that their regulations will not allow them to permit foreign instruments to be used on their lines.

The meeting of interurban railway men, which was announced for January 19 at Syracuse, was held on January 24 at that place. A list of the papers read appeared in these columns January 14.

COMMISSION NEWS FROM WISCONSIN.

(Special Correspondence.)

The Commission has authorized the Madison Gas and Electric Company to issue $727,000 par value of thirty-year gold bonds. These bonds are to be issued in denominations of $1,000 each, bearing interest at the rate of six per cent per annum and are to be issued under the terms of a mortgage or trust deed given to the Bankers Trust Company of New York, trustees.

The Commission has made a report informally on the rates and financial condition of the Brodhead Electric Company. The report contains a summary of the cost of power generation for a number of plants in the state divided into three classes—those plants operating in cities over 10,000 population; those plants operating in cities of less than 10,000 and over 500; and those plants operating in cities under 500 population. This summary is as follows:

	Over 10,000	Under 10,000	500 or less
Minimum	.913	1.467	1,404
Maximum	3.081	8.646	16.250
Average	2.216	3.697	6,028
Median	2.124	3.053	6.174

These figures represent cost of power generation in cents per kilowatt-hour. The corresponding figures for the Brodhead plant for the last fiscal year was 2.36 cents per kilowatt-hour. The Commission suggested that the flat rates of the Company should be varied somewhat to accomodate long-hour users and that the meter rates should be changed to a form somewhat as follows: Ten cents for the first thirty hours' use per month of the active connected load and eight cents per month for the excess. It was found that the Company was selling current to power consumers at less than the cost of producing the current. A rate of seven cents per kilowatt-hour for the first thirty hours' use and five cents per kilowatt-hour for the excess was suggested for commercial power.

The Supreme Court has handed down a decision in the case involving the Kenosha Gas and Electric Company and the Kenosha Electric Railway Company, in which the indeterminate permit provision of the public utility law has been upheld, and the Kenosha Electric Railway Company is therefore barred from doing a lighting business in Kenosha unless granted a certificate of public convenience and necessity by the Commission.

The City of Genoa Junction and the Genoa Junction Electric Light Plant have appealed to the Commission to settle a dispute between the City and the Company as to rates for street lighting. The Company wished to raise the rates for thirty-two-candlepower incandescents from $10.00 to $18.00 a year. The City opposed such increase and by agreement between the parties it was left to the Commission to determine upon a fair rate. The municipal electric plant at Black River Falls has asked the Commission to fix and determine a fair and equitable rate for day power service. The City has recently completed the construction of a new dam and power plant on the Black River and has plenty of power to supply day power users. The City is also considering the selling of energy to one or two smaller towns in the vicinity.

The City of Washburn and the Washburn Electric Light and Power Company have submitted the determination of a fair rate for lighting the streets of Washburn to the Commission. The plant was purchased by the City several years since, but it was found that the City had exceeded its legal limit of bonded indebtedness and the plant was turned back to the Company. Since that time the streets have been unlighted and the whole question has now been referred to the Commission by agreement of the parties. The Company has proposed to light the City with 100-watt tungstens on the following schedule:

2 hours use per day of the lamps	10 cts. per kilowatt-hour
5 hours use per day of the lamps	9 cts. per kilowatt-hour
5 hours use per day of the lamps	8.4 cts. per kilowatt-hour
6 hours use per day of the lamps	8 cts. per kilowatt-hour

An increasing number of smaller plants, both municipal and private, are voluntarily submitting their rate schedules to the Commission for informal consideration and attention, looking towards a more equitable rate system.

LIGHTING AND POWER.

(Special Correspondence.)

GRAND RIVER, IOWA.—It is proposed to organize a company to install an electric light plant. C.

OPELOUSAS, LA.—This city will make improvements to its electric light plant, installing new machinery. P.

HOUSTON, TEX.—The Brown-Woods Electric Company has increased its capital stock from $10,000 to $15,000. P.

UTICA, NEB.—A vote will be taken February 7 on the construction of an electric light plant at a cost of $5,000. C.

MANSON, IOWA.—The village board is considering the installation of an ornamental lighting system for the streets. Z.

BELVIDERE, ILL.—The Belvidere City Council has closed a ten-year contract with the Public Service Operating Company for the lighting of the streets.

ANOKA, MINN.—A bill authorizing the Great Northern Development Company to construct a dam across the Mississippi River, has been approved. C.

CENTRAL CITY, IOWA.—A vote will be taken January 30 on granting a franchise to Fred J. Cross to install an electric light plant at a cost of $30,000. C.

VIOLA, WIS.—The Viola Light and Power Company has been incorporated with capitalization of $25,000. The incorporators are C. R. Thomson, A. A. Thomson and C. S. Thomson. Z.

TAYLORVILLE, ILL.—The Taylorville Gas & Electric Company was the lowest bidder for lighting the ornamental lamps about the public square and will be awarded the contract. Z.

IOWA FALLS, IOWA.—The Petersen Heat & Light Company, backed by Oscar F. Petersen, of Des Moines, has asked for a twenty-five-year franchise for the sale of light and heat. Z.

MAYSVILLE, MO.—The DeKalb County Electric Light Company has been incorporated with capital stock of $15,000. The incorporators are E. A. N. Bunton, W. F. Wingate and O. W. Idon. Z.

SPENCER, NEB.—W. J. Woods proposes to install an electric light plant, using two thirty-five-horsepower gas engines for driving the generators. The cost of installation is estimated at $8,000. C.

FREMONT, NEB.—The Council will install an electrolier lighting system in the business section. The Fremont Gas & Electric Company will make a number of extensions to its system during the year. C.

FORT BLISS, TEX.—The War Department has taken the preliminary steps towards the installation of an electric light plant at this military post. It is estimated that it will cost between $17,000 and $24,000. D.

ST. PAUL, MINN.—Col. J. H. Davidson, of the State Waterways Commission, recommends the construction of a 60,000-horsepower steam plant as an auxiliary to the waterpower installation at the high dam. C.

WEBSTER CITY, IOWA.—The City has secured a site for the erection of the new power plant, work on which will be started as soon as weather will permit. It will be modern and fireproof throughout. C.

COLLINSVILLE, OKLA.—The Peoples' Ice & Light Company has been incorporated with a capital of $50,000. The incorporators are J. M. Middleton, H. G. Barndollar, C. L. Goodale and C. T. McCarthy.

UPPER SANDUSKY, O.—The American Gas & Electric Company, of Providence, R. I., has purchased the local plant of the Citizens' Light & Power Company. The consideration is said to have been $19,900. H.

WEYAUWEGA, WIS.—The assignees of Weed, Gumaer & Company have purchased the stock in the lighting plant held by Messrs. Hinchey and Phillips, and now have full control. The Company is capitalized at $20,000.

PLYMOUTH, N. C.—The state has chartered the Plymouth Light and Ice Company, of this city, which is capitalized at $25,000, and which was organized by A. L. and L. C. Owens, and Clarence Latham, all of Plymouth.

MISHAWAKA, IND.—The City Council has voted to install a modern pumping plant in the eastern part of the city. The wells are already completed. The power will be electricity and plans are being prepared for bidders. S.

WARRENTON, N. C.—The Warrenton Electric Company, of this city, has just taken out a charter to do business in Warrenton. The Company's capital stock is $20,000. Those interested include W. G. Rogers and associates, of Warrenton. L.

ABERDEEN, WASH.—E. C. Miller has applied for a twenty-five-year franchise in this city. Mr. Miller has formed a company which is known as the Citizens Lighting & Power Company and which will be incorporated in the event of the franchise being granted.

ROCK ISLAND, ILL.—Samuel S. Davis and Thomas B. Davis have let the contract to the Westinghouse Electric & Manufacturing Company for one exciter, one motor-generator set, six vertical generators and a seventeen-panel switchboard for the Sears waterpower development plant. Z.

MINNEAPOLIS, MINN.—The Minneapolis General Electric Company is planning the erection of a plant to replace the one which was burned recently, at a cost of about $750,000. In the meantime a turbine and two transformers will be installed temporarily on the bare ground in front of the ruins. C.

MINNEAPOLIS, MINN.—The Minneapolis General Electric Company has secured waterpower sites at Clearwater, Otsego and Monticello, and expensive plants will be built at each one. The Company will expend $1,500,000 this year in substations, storage batteries, land-sites and in extensions to be made to the underground system. C.

NEW LONDON, WIS.—The Municipal electric light plant was burned recently. It was but partly insured. The Council will rebuild and in the meantime, has let the contract to Leonard Wallwe for the erection of a temporary building. The purchase of a dynamo has been arranged for. It has been voted to bond the city $20,000. C.

MUNCIE, IND.—The patrons of the Muncie Heat, Light & Power Company are resisting the adoption of a minimum charge of fifty cents for every service connection. The Board of Public Works holds that the franchise does not allow the Company to fix a minimum rate. The Company insists that the charge is absolutely necessary to enable it to meet expenses. S.

WATERLOO, IOWA.—The Waterloo, Cedar Falls & Northern Railway Company will use a 120-horsepower motor to operate the riding devices at Electric Park which it has leased for next summer. Four and eight-candlepower lamps will be supplanted by sixteen-candlepower, 2,700 bulbs being called for. Tungstens will be used wherever possible and arcs will be entirely supplanted by tungsten groups. Z.

EAST ST. LOUIS, ILL.—A lighting committee from the Down Town Club will supply one hundred and twenty ornamental poles, through the local electric light company to support arc lights to be placed every seventy-five feet on each side of streets in the business section of the city. The City will pay for the current. Herman C. Thoene is chairman of the Club's lighting committee. Z.

STOUGHTON, WIS.—This place will hold a special election on January 31 to vote on issuing $18,700 of bonds for the purpose of purchasing the Stoughton mill property, consisting of several acres of land, two large frame buildings, and the mill dam with accompanying waterpower rights for ninety-nine years. It is proposed to improve the dam, which will furnish power and light for the town. M.

RAPIDAN, MINN.—The large power dam here which will furnish power for the southern part of the state has been practically completed and the lake behind the structure is almost filled. The dam, which was erected by the H. M. Byllesby Company, of Chicago, is sixty feet high and is surmounted by a bridge. The whole structure, including the power house, is of reinforced concrete. The lake formed will be five miles long. M.

ST. PAUL, MINN.—Oscar Clausen, former city engineer has presented a report upon the high dam in the Mississippi River proposition in which he finds the project is capable of furnishing 10,000 horsepower for twenty-four hours or 240,000 horsepower hours. In the plan of using this, a plant with a peak-load capacity of 20,000 horsepower with a reserve plant of 4,000 horsepower and an auxiliary steam plant of 3,000 horsepower is recommended. Z.

BURNET, TEX.—In a suit by Herman Richter of this place against the Colorado River Power Company, which is constructing a large dam across the Colorado River at Marble Falls, and installing a hydroelectric plant there, for $50,000 alleged damages for conversion of water rights claimed by plaintiff, Judge Clarence Martin of the district court has rendered judgment for the defendant company. He holds in this decision that the rights of the company were superior to Mr. Richter's, by virtue of its files and construction of the dam. D.

WATERVILLE, ME.—A majority of the stock of the Skowhegan Electric Company has been secured by purchase by the Central Maine Power Company of this city. The Skowhegan Company controls a water power development of 600 horsepower with 500 horsepower in a steam auxiliary. The Central Maine Power Company now controls water power privileges in Winslow, Oakland, North Vassalboro, Augusta, Pittsfield, Benton and Skowhegan, totalling 7,500 horsepower and 3,500 in steam auxiliaries. It also has riparian rights capable of developing 25,000 additional horsepower.

TOLEDO, O.—Frank Hafer, treasurer of the Milburn Wagon Works, and Charles F. Meilink, of the Meilink Manufacturing Company, both of Toledo, were elected to fill the vacancies in the directorate of the Toledo Railways & Light Company, caused by the death of Dr. J. F. Demers, of Canada, and the resignation of William B. Hale, of Chicago. The remaining directors were re-elected at the annual meeting and the following officials chosen: President, Albion E. Lang; vice-president and general manager, L. E. Beilstein; secretary and auditor, H. S. Swift; treasurer, Spencer D. Carr. John F. Collins will continue as assistant general manager. H.

PORTALES, N. M.—The American Beet Sugar Company which will erect a large beet sugar factory at this place is also arranging to install a large electric power plant and to construct an electric railway between Portales and Taiban, N. M., traversing the center of the proposed sugar-beet district. This road will do both a freight and passenger business. The American Beet Sugar Company lends money to the farmers and binds itself to dig wells, install the electric irrigation pumping plants, the cost of the latter to be paid for by the farmer in twenty annual installments without interest. The consummation of this big project will create a large demand for irrigation pumping machinery. D.

CHARLOTTE, N. C.—Following the taking over by the Southern Power Company interests of the 4 C's Company, electric railway and power and gas interests, a meeting of the stockholders and directors of the Charlotte Electric Light and Power Company, was held, at which officers of the concern were elected, as follows: President, Z. V. Taylor; secretary and treasurer, E. C. Marshall, vice-president and general manager, W. S. Lee, Jr. The officers of the newly purchased Charlotte Gas and Electric Company are Z. V. Taylor, president; A. V. Harrill, vice-president; D. G. Calder, treasurer; E. C. Marshall, secretary. Directors elected for the Charlotte Electric Railway Company under the new regime, are Messrs. J. B. Duke, Z. V. Taylor, formerly of Greensboro, L. C. Harrison and W. S. Lee. Directors of the Charlotte Gas and Electric Company elected are Messrs. Z. V. Taylor, W. S. Lee, Jr., and A. V. Harrill. The Southern Power Company now controls the electric lines, city and suburban, in Anderson, S. C., Greenville, S. C., and Charlotte, N. C., and is building an interurban line to extend from Anderson, N. C., via Greenville, S. C., and Spartanburg, Gastonia, Charlotte, Greensboro, and Durham, a total distance of about 300 miles. L.

ELECTRIC RAILWAYS.

(Special Correspondence.)

BELLEVILLE, ILL.—The East St. Louis and Suburban Railway will build a substation here to cost $3,000. Z.

IOWA CITY, IOWA.—The Iowa City-Cedar Rapids Interurban Railway Company is planning to expend $80,000 in improving its plant and road. C.

GREAT FALLS, MONT.—The car barns and repair shops of the Great Falls Electric Properties at Black Eagle park were burned. The loss of $20,000 was covered by insurance. C.

IOWA CITY, IOWA.—Arrangements have been completed for financing the construction of an interurban road to Ottumwa, by way of Sigourney. Arnold & Company, of Chicago, are the engineers. C.

BELLEVILLE, ILL.—The Belleville & Interurban Railway Company's line which extends from Belleville to Smithton, a distance of seven miles, was sold by the Master-in-Chancery to T. T. Hinde of Belleville for $600 on foreclosure to satisfy a judgment of $23,522.92. Z.

DAVENPORT, IOWA.—The Tri-City Railway & Light Company has commenced the survey of an interurban line to Muscatine. K. C. Weeden is the construction engineer. Work will shortly be resumed on securing funds for the construction of a Davenport-Iowa City interurban. C.

CLAY CITY, IND.—A home organization has been formed to promote the building of an interurban road from Brazil to Jasonville by way of Clay City, a distance of thirty miles. An election on the matter of a subsidy in aid of the road will be held in the townships through which the line will run.

CLINTON, IND.—Steps have been taken by a local company headed by Mayor H. M. Ferguson, to construct and operate a street-car system between Clinton and Fairview Park, an incorporated town two miles north. This will be conducive to the building up of the intermediate territory and uniting the two towns.

GENESEO, ILL.—Officers have been elected by the Rock River Traction Company as follows: President and general manager, Hugh W. Cole, Geneseo; first vice-president, H. J. H. O'Bryan, Geneseo; second vice-president, Bernard Lacher, Geneseo; secretary, William Harbaugh, Geneseo; treasurer, C. F. Luther, Geneseo. Active construction work will be taken up in 1911, according to the president. Z.

COLUMBUS, IND.—The Indianapolis, Columbus & Southern Traction Company is experimenting with a block-signal system. A single block has been installed and results are regarded satisfactory. The block is equipped with an automatic appliance to stop cars. If a car passes a stop signal and enters the block, it is automatically stopped by the appliances of the brakes and air. The car cannot be started again until the motorman disconnects the automatic stopping apparatus. S.

WINSTON-SALEM, N. C.—Another important enterprise for the new year is announced here with the publication of the proposed issue of $2,000,000 bonds to finance an interurban electric line from this city to Floyd, in Virginia. The new concern is strongly backed and is to be known as the North Carolina Traction Company, with a road ninety-two miles in length, and with the following officers already chosen: President, A. M. Clarke, Southern Pines, N. C.; vice-president, J. W. Sykes, of Raleigh; general manager, E. L. Kraft, of Indianapolis, Ind.; secretary, J. W. Kraft, of Indianapolis; treasurer, H. M. McAlister, Lumberton, N. C. Work on the new line will be started soon. L.

TELEPHONE AND TELEGRAPH.

(Special Correspondence.)

NEW LONDON, WIS.—The installation of a new telephone exchange is being agitated. C.

MALMO, MINN.—In the early spring the Eastside Telephone Company will build a line into Aitkin. C.

CRYSTAL LAKE, IOWA.—The North Crystal Farmers Telephone Company is extending its lines. C.

CHARLES CITY, IOWA.—The Western Electric Telephone Company will extend two circuits to West Union. C.

EUREKA, CAL.—The Eel River & Southern Telephone Company has been incorporated by H. D. Smith, E. M. Loveland, R. M. White and others, with a capital stock of $20,000. A.

KERMAN, CAL.—The Vinland Telephone Company has been incorporated by J. C. Ashin, R. S. Elliott, Wilfred Baker, P. H. Carlsgaard and N. O. P. Synoground, with a capital stock of $25,000. A.

SINTON, TEX.—D. Odem of this place recently sold the local telephone exchange to the Southwestern Telegraph and Telephone Company. The new owner will make extensions and improvements, it is announced. D.

SWEETWATER, ILL.—The Sweetwater Telephone Company has been incorporated with a capital stock of $2,400 to operate a mutual telephone line. The incorporators are J. E. Brasfield, T. H. Alkire and John W. Terhune. Z.

ROCKFORD, ILL.—The following officers will serve the Rockford Home Telephone Company the coming year: President, T. M. Ellis; vice-president, R. S. Chapman; secretary, John H. Camlin and treasurer, F. F. Wormwood. Z.

SAN MARCOS, TEX.—The San Marcos Telephone Company which was recently reorganized has installed the flashlight system and will make other important improvements. Merton Swift has been appointed general manager. D.

PECOS, TEX.—The Reeves County Telephone Company, which has its principal office at Pecos, has added to its already extensive holdings by the purchase of the Barstow telephone system, which extends to various points in the Barstow section of the Pecos River valley, including Grand Falls. The acquisition of this system gives the Reeves County Telephone Company nearly one thousand miles of lines. J. C. Gaither is president and principal owner of the Company. It has exchanges at Pecos, Toyah, Balmorhea, Barstow and Grand Falls.

SAN FRANCISCO, CAL.—The Poulsen Wireless Company has been corporated here with a capital stock of $25,000,000 by Beach Thompson, E. W. Hopkins, of the Hopkins Estate, president of the Union Ice Company and director of the Bank of California; George A. Pope, member of the firm of Pope & Talbot; Howard P. Veeder, formerly interested with Mr. Thompson in the Stanislaus River Power Company; J. Henry Meyer, of the banking firm of Antoine Borel & Company, and director of the Wells-Fargo National Bank and the Union Trust Company, and S. E. Slade, of the Slade Lumber Company. The new company will exploit in the United States the wireless telegraph and telephone patents of Valdemar Poulsen, of Copenhagen. The Company will not enter the active field for some time, and its present work will consist of a series of tests and experiments. Communication, both by wireless telegraph and wireless telephone, has been established between San Francisco and Stockton. The local station has been established at the Ocean Beach. It includes two square steel masts. A.

ELECTRICAL SECURITIES.

During the week past, the market has been good, and has shown, with a slight increase in stocks, a decidedly larger volume of bond transactions. The market was decidedly firmer, and there has been a general drop in loan rates. Iron and steel products have increased in price by about $1.00 per ton, although there has been but little increase in the orders for steel. A favorable development of the week was the conclusion of the arguments in the Standard Oil and American Tobacco cases in the Supreme Court. Now that these are finished, decisions showing what the Sherman anti-trust law means cannot be very far off.

Metropolitan West Side Elevated annual meeting will be held February 6.

The Cities Service Company reports for the quarter ended December 31, 1910, net earnings available for dividends $250,139.

At the annual meeting of the Toledo Railways & Light Company, Mr. Mink was elected a director to succeed Joseph F. Demers. Other directors were re-elected.

Clark, Dodge & Company, of New York, and E. W. Clark & Company, of Philadelphia, are offering $1,653,000 Denver City Tramway Company first and refunding sinking fund mortage twenty-five-year five-per-cent gold bonds at ninety-five and interest, to yield 5.38 per cent. The bonds are part of an authorized issue of $25,000,000, of which $4,720,000 are outstanding. They are callable as a whole, but not a part, except for the sinking fund, at 105 and interest from May 1, 1914, to November 1, 1923, inclusive, and thereafter at 102½ and interest. The bonds are secured by direct mortgage on 197 miles of track within the city limits of Denver, Colo. For the year ended December 31 last, the company showed a surplus of $676,000 over fixed charges amounting to $1,063.000. The company operates the entire street railway system of Denver, consisting of 223 miles of track.

DIVIDENDS.

Cities Service Company; a monthly dividend of one-half of one per cent on the preferred stock, and one-fourth of one per cent on the common stock, payable February 1 to stock of record January 20.

Commonwealth Edison Company; quarterly dividend of one and one-half per cent, payable February 1.

East St. Louis & Suburban Company; quarterly dividend of one and one-fourth per cent on the preferred stock, payable February 1 to stock of record January 14.

Edison Electric Illuminating Company of Boston; regular quarterly dividend of $3 a share, payable February 1 to stock of record January 19.

Metropolitan West Side Elevated; quarterly dividend of three-quarters of one per cent, payable March 1.

Montreal Light, Heat and Power Company; increased rate of dividend from seven per cent to eight per cent by declaring quarterly dividend of two per cent for the quarter ended January 21, payable February 15.

Omaha Electric Light and Power Company; regular semi-annual dividend of $2.50 a share on the preferred stock, payable February 1 to stock of record January 20.

Pacific Gas and Electric Company; quarterly preferred dividend of $1.50 per share, payable February 15.

Pacific Power and Light Company; quarterly preferred dividend of one and three-quarters per cent, payable February 1.

Washington Water Power Company; quarterly dividend of two per cent, payable April 1.

West Penn Railways Company; regular quarterly dividend of one and one-quarter per cent on the preferred stock, payable February 1 to stock of record January 25.

Western Telephone and Telegraph Company; semiannual preferred dividend of $2.50 per share, payable February 1.

CLOSING BID PRICES FOR ELECTRICAL SECURITIES ON THE LEADING EXCHANGES AS COMPARED WITH THE PREVIOUS WEEK.

NEW YORK.

	Jan. 23.	Jan. 16.
Allis-Chalmers common	8	8
Allis-Chalmers preferred	28½	28¼
Amalgamated Copper	64¼	64¼
American Tel. & Cable	82	82
American Tel. & Tel.	143½	142⅝
Brooklyn Rapid Transit	77	76¼
General Electric	151	150½
Interborough-Metropolitan common	19	19¼
Interborough-Metropolitan preferred	53	54
Kings County Electric	123	123
Mackay Companies (Postal Telegraph and Cables) common	92	92¼
Mackay Companies (Postal Telegraph and Cables) preferred	74¾	74¾
Manhattan Elevated	138	138
Metropolitan Street Railway	*18	*18
New York & New Jersey Telephone	103	103
Pacific Tel. & Tel.	51¾	46
U. S. Steel common	77	76½
U. S. Steel preferred	118¾	118½
Western Union	74¾	74½
Westinghouse common	67½	66½
Westinghouse preferred	110	110

*Last price quoted.

BOSTON.

	Jan. 23.	Jan. 16.
American Tel. & Tel.	143½	142½
Edison Elec. Illuminating	287½	288
General Electric	151	150½
Massachusetts Electric common	18	17
Massachusetts Electric preferred	85	84¼
New England Telephone	137½	137
Western Tel. & Tel. common	18	16
Western Tel. & Tel. preferred (ex dividends)	88	91

PHILADELPHIA.

	Jan. 23.	Jan. 16.
American Railways	44¾	43
Electric Company of America (ex dividends)	12½	12¼
Electric Storage Battery common	54⅛	50
Electric Storage Battery preferred	54⅛	50
Philadelphia Electric	16	16¼
Philadelphia Rapid Transit	20⅞	19⅞
Philadelphia Traction	86½	85
Union Traction	48¼	45⅝

CHICAGO.

	Jan. 23.	Jan. 16.
Chicago Railways, Series 1	93	96
Chicago Railways, Series 2	24	24½
Chicago Subway	4	4½
Chicago Telephone	118	120
Commonwealth Edison	113	113
Metropolitan Elevated common	21	20
Metropolitan Elevated preferred	67	68
National Carbon common	117	117
National Carbon preferred	115	115

PERSONAL MENTION.

C. N. BROUSTER, St. Louis representative of the Excello Arc Lamp Company, was a Chicago visitor last week.

D. M. BLISS, who joined the Edison engineering staff a year ago as electrical engineer, has been appointed chief engineer of the Edison laboratory, West Orange, N. J.

GEORGE J. COX has been elected president of the New York Electrical School, Inc., of New York City. He will also retain the position of managing director of the school and business.

WILLIAM P. SIDLEY, vice-president and general counsel of the Western Electric Company, has been elected president of the Young Men's Christian Association of Chicago. Mr. Sidley succeeds Edward P. Bailey.

T. C. HARD, of Terre Haute, Ind., has succeeded John H. Sullivan as superintendent of exchanges and toll lines of the Citizens' Telephone Company with headquarters at Pekin, Ill. Mr. Sullivan has retired to his farm near Havana, Ill.

A. G. M'CLURE, who for the past four years has been associated with the American Conduit Company, East Chicago, Ind., has resigned to take a position in the subway construction department of the Safety Insulated Wire and Cable Company.

BION J. ARNOLD, the well-known consulting engineer and electric traction expert, was again honored by having conferred on him on January 18 the degree of Doctor of Engineering by the University of Nebraska, which he attended for a year during his early youth.

F. L. JOHNSON, associate editor of *Power and the Engineer*, lectured before the Modern Science Club of Brooklyn, on January 24, on the subject, "Some Recent Boiler Explosions." Mr. Johnson's lecture was illustrated by an interesting set of lantern slides.

C. P. HAMLIN has resigned his position as secretary and general manager of the People's Mutual Telephone Company, Nekomis, Ill., to accept a place with the Hillsboro Electric Light & Power Company, Hillsboro, Ill. He will be succeeded by R. P. Banard.

PROF. D. C. JACKSON sailed on the *Lusitania* on January 18 to spend a week in London conferring in regard to the execution of the valuation of the plant of the National Telephone Company. He will return by the *Kronprinz Wilhelm*, which is due to arrive in New York February 7.

C. O. BAKER, president of C. O. Baker & Company, Inc., platinum manufacturers, of Newark, N. J., sailed from New York on Saturday, January 21, for a three-months cruise in the Southern Seas. Mr. and Mrs. Baker will visit several of the more important parts of the West Indies and Brazil, going around the South American coast to Santiago, Chile.

JOHN I. BEGGS, president and general manager of the Milwaukee Electric Railway & Light Company, met with a serious accident on January 18. While leaving his automobile he slipped on the ice and sustained a severely fractured wrist. Notwithstanding this Mr. Beggs attended a session of the Wisconsin Electrical Association at Milwaukee on January 19.

R. C. LANPHIER, of the Sangamo Electric Company, Springfield, Ill., read a paper entitled "The Ampere-hour Meter for Electric Vehicles" at the annual meeting of the Society of Automobile Engineers, held at New York, January 11 and 12. A considerable amount of data was given as to operation of electrically-driven delivery wagons under commercial conditions.

G. K. HEYER, of the Western Electric Company, addressed the Telephone Society of Rhode Island on Tuesday evening, January 17, 1911, at Providence, R. I. The subject was "Train Dispatching by Telephone." Mr. Heyer has a very pleasing delivery which, combined with his interesting subject, resulted in a very entertaining as well as instructive evening. The subject was handled with simplicity and clearness. Mr. Heyer supplemented his talk with lantern slides which were not confined to views of the interiors of train-dispatching offices.

H. THURSTON OWENS, consulting engineer, New York City, has been appointed associate editor of the *American Gas Light Journal*, 42 Pine Street, New York City. Mr. Owens has been connected with the lighting industry for the past ten years, and has been a frequent contributor to the technical press. He is quite active in association work, being a member of the American Gas Institute, National Commercial Gas Association, New York Electrical Society, Illuminating Engineering Society, and a corresponding member of the British Illuminating Engineering Society.

WILBUR B. FOSHAY resigned his position as manager of the Pacific Power & Light Company, at Walla Walla, Wash., to accept the management of the properties of the Washington-Oregon Corporation, at Vancouver, Wash. Mr. Foshay was with the New York Central Railroad for about five years. He then entered the gas and electric business for the United Gas Improvement Company, at its branch at Tarrytown, under the management of the Westchester Lighting Company's Mt. Vernon office. He worked up through the various departments and left to accept the position as assistant to the manager of the Water, Light & Gas Company at Hutchinson. He was then connected with one of the subsiidary companies of the New Jersey Zinc Company, at the plant at Depew, Ill. From there he went to Fort Dodge, Ia., as general manager of the gas and electric properties there. While in charge of these properties he rebuilt the gas and electric generating stations and the electric distribution system. From this place he went to the management of the natural gas and electric properties at Wichita, Kans. In this city he did much construction work in both the gas and electric departments. He was then sent to Walla Walla in charge of a hydraulic property which also had a steam plant and gas property in connection. Here he secured extensions of the Company's lines into new irrigating sections, and he started a thirty-mile extension in what is known as the Hudson-Bay district just out of Freewater, one of the cities that came under his management from Walla Walla. At Vancouver he will have a gas, electric interurban, street railway and water works.

OBITUARY.

J. W. BROCK, president of the Kankakee & Urbana Electric Railway Company, died January 17, at his home in Urbana, after a three weeks' illness with typhoid fever. He was fifty years old and leaves a wife and several children.

JOHN J. McLAUGHLIN, who was well known in political and engineering circles in New York City, died on January 19, at his home in Jamaica, L. I. He is survived by a widow and eight children.

ALBERT BURNSTINE, formerly lieutenant in the United States Army, and vice-president of the Radio Telephone Company, died recently at his home in New York. Mr. Burnstine was born in Detroit, Mich., and was graduated from the United States Naval Academy in 1885. He was honorably discharged from the service two years later. He served as a Lieutenant with the Volunteers in the Spanish war.

HENRY WENTWORTH BROWN, president of the Transportation Equipment Company, died on January 19 in New York. Mr.

Brown has been interested in railroad affairs for many years, and was recognized as an authority in New York City transportation affairs. He was a member of the New York Railroad Club, Minnesota Society of New York, Scarsdale Golf and Country Club and the American Electric Railway Association.

WILLIAM H. BROWNE died recently at his home in Brooklyn of exhaustion due to cancer. Mr. Browne was sixty-one years of age at the time of his death. He was born in Troy, N. Y., and was educated in the Christian Brothers School there. Upon turning his attention to electricity some time later, he helped to build, in Richmond, Va., one of the first electric railways in the United States. At the time of installation of the first alternating-current high-tension generators for lighting in New York, he was general manager of the United Electric Light & Power Company in New York City. He was interested in the works of the Cataract Power Company at Hamilton, Ont., and built up the business of the Royal Electric Company, which was later turned over to the Canadian General Electric Company. His last work in Canada was the consolidation of several large Canadian companies. In 1902 he resigned his position of this concern, the Montreal Light, Heat & Power Company, becoming general manager and treasurer of the Stanley Instrument Company. On the consolidation of this company with the General Electric Company he opened up consulting engineering offices. At the time of his death he was engaged in the work of building the dam of the Rockingham Power Company at Rockingham, N. C. Mr. Browne was a member of the American Institute of Electrical Engineers, of the St. Lawrence, Montreal and Catholic Clubs and was a past grand master of the Knights of Columbus. He is survived by five children.

NEW PUBLICATIONS.

ELECTRIC LAMP BULLETINS.—The engineering department of the National Electric Lamp Association has just issued three technical bulletins on incandescent lamps. These publications are as follows: Bulletin 5-C, "Tantalum Multiple Lamp;" Bulletin 8-B, "Mazda Miniature and Low-voltage Lamp," and Bulletin 15, "Electric Sign Lighting." Each of these publications succeeds one on the same subject published previously. Copies of them may be obtained from the engineering department of the National Electric Lamp Association, Cleveland, O.

FREIGHT TRAIN RESISTANCE: ITS RELATION TO CAR WEIGHT, by Edward C. Schmidt, has just been issued as Bulletin No. 43 of the Engineering Experiment Station of the University of Illinois. This bulletin presents the results of tests made upon freight trains to determine their resistance. The results show that the average weight of the cars composing the trains exerts upon train resistance an even greater influence than is exerted by variations in train speed. Copies of the Bulletin No. 43 may be obtained gratis upon application to W. F. M. Goss, director of the Engineering Experiment Station, University of Illinois, Urbana, Ill.

CEMENT PAPERS CONSOLIDATE.—With the January issue, the *Cement Age* of New York, and *Concrete Engineering* of Cleveland, O., consolidated and will hereafter be issued under the name "Cement Age with which is combined Concrete Engineering." It is the purpose to preserve the best features of both the magazines, thus maintaining the prestige each has won. The use of cement from the architectural and engineering standpoints, as well as its manufacture, will be thoroughly covered, together with the popular features that are of such great interest to the general public. Allen Brett, editor of *Concrete Engineering* for the past two years, will take the position as associate editor of the new publication, and Arthur E. Warner, formerly business manager of *Concrete Engineering*, will become western manager. There will be no change in the present staff of *Cement Age*, Mr. Lesley continuing as editor, Frederic F. Lincoln as president of the Cement Age Company, in charge of the New York office at 30 Church Street and of the eastern advertising field, and Edward A. Trego as associate editor.

CHANGE IN THE VALUE OF THE INTERNATIONAL VOLT.—The Bureau of Standards, Department of Commerce and Labor, Washington, D. C., has issued circular number 29, which consists of an announcement of a change in the value attributed to the normal Weston cell. The value heretofore used in the United States is 1.01913 volts at twenty degrees centigrade. The value to be used hereafter is 1.01830 volts. The former differences in the units in vogue in other countries is considered, and the action of the London Conference of 1908 reviewed. International agreement upon the present value is the result of the work of representatives of the national standardizing laboratories of the United States, England, Germany and France, as reported at the time this committee met in Washington last spring. The international committee having in charge the specifications for the silver voltameter and the standard cell have accepted the results of their work. This increase in the size of the standard volt affects the standard of current in the same way and the unit of power is thus increased 0.16 per cent. The new value went into effect January 1, and for a time the certificates issued by the Bureau will state the values in terms of both the new unit and the old unit. Congress will be asked to repeal the Act of July 12, 1894, and define the fundamental electrical units in accordance with the resolutions of the London Conference of 1908.

INDUSTRIAL ITEMS.

THE NEW YORK & OHIO COMPANY, Warren, O., is distributing folders on the subject of Packard Mazda lamps for automobile lighting.

THE GARVIN MACHINE COMPANY, New York, N. Y., recently mailed to the trade circulars Nos. 142 and 143. The former describes Garvin vertical-spindle milling machines, and the latter deals with Garvin No. 3 duplex milling machines.

H. T. PAISTE COMPANY, Philadelphia, Pa., has distributed calendars for the present year. Each page is imprinted with a design of Paiste Pipe Taplets geometrically arranged, and has also various Paiste specialties in the vacant date spaces.

FRANK MOSSBERG COMPANY, Attleboro, Mass., describes a variety of wrenches, bells, stamped-steel reels, beams, spools and sheet-metal stampings and punchings of all kinds in catalog No. 13, which was recently published. The catalog is well illustrated.

THE ILLINOIS ELECTRIC COMPANY, Chicago, Ill., has issued its January price list and discount sheet applying to Catalog No. 19, in which is listed a complete line of the electrical goods carried by it. The Company has also enclosed folders illustrating Vivax batteries and Holophane glass shades.

THE EMERSON ELECTRIC MANUFACTURING COMPANY, St. Louis, Mo., illustrates a number of electric fans of various types in the January number of the *Emerson Monthly*. A number of views of parts of Santo vacuum cleaners are also shown in connection with a description of these devices.

JULIUS ANDRAE & SONS COMPANY, Milwaukee, Wis., announces that in spite of the fire which recently destroyed its supply house it is filling orders and is filling them rapidly. Stock is being brought in in large quantities by the boat lines and rail lines, and the regular Julius Andrae service is being given to customers.

THE WATERBURY COMPANY, New York, N. Y., calls especial attention in a late folder, to the seven submarine cables which have been laid across the Harlem River for the Union Railway Company. A showing illustration of this cable is given in the folder. The Company manufacturers and installs complete cable systems.

THE DRIVER-HARRIS WIRE COMPANY, Harrison, N. J., is distributing a new booklet containing much information of interest. Numerous quick-reference tables are included, and two new alloys are mentioned as having been recently perfected. These are the "Yankee silver" and "Thermo." A copy of the booklet will be sent by the Driver-Harris Company on request to them.

THE GARWOOD ELECTRIC COMPANY, Garwood, N. J., has distributed Bulletin No. 508 G., in which are illustrated a number of welds made by the Garwood system. Some of these photographs were taken in steel mills, and two of the pictures show a steel crank shaft before and after repairing a break. A bulletin giving extensive data on electric welding is now in operation.

THE CONSOLIDATED RAILWAY ELECTRIC LIGHTING & EQUIPMENT COMPANY, New York, N. Y., announces that Thomas L. Mount has been appointed eastern sales agent of the company with offices in the Hanover Bank Building, New York City. L. J. Kennedy has been made western sales agent with offices at 1720 Michigan Avenue, Chicago.

PARAGON SELLERS COMPANY, Chicago, Ill., publishes a number of facts regarding grounding in the January number of the *Paragon Bulletin*. Several illustrations of pipes subjected to electrolysis are shown, and numerous diagrams of connections are included, which give an excellent idea of the number of ways in which the Paragon ground cone may be used.

THE NATIONAL ACME MANUFACTURING COMPANY, Cleveland, O., has developed the history of the "Acme Automatic" lathe in a booklet which was recently published. A number of the machines are described, which take four bars at one time instead of only one bar as do the ordinary automatics. Several interesting illustrations of the lathes and the pieces which are turned out are included.

PETTINGELL-ANDREWS COMPANY, Boston, Mass., contains articles on the new "Examplar" Pelouze toaster-stove and griddle, "Flexilyte," "Examplar" tool belt with safety straps and other goods both new and of standard design. An interesting diagram shows the candle power consumption in watts and the cost of operation per hour, of various types of incandescent lamps. The sixth of the series of wiring tables also appears in this issue.

THE LEEDS & NORTHRUP COMPANY, Philadelphia, Pa., is issuing a new series of catalogs, the first of which has recently been mailed. The Company has discontinued its general catalog, and is now publishing section catalogs, each section being devoted to a separate line of instruments. The present catalog describes apparatus for measuring low resistance and conductivity and contains a number of illustrations and diagrams in addition to complete price lists.

THE ROBBINS & MYERS COMPANY, Springfield, O., has opened a St. Louis branch office and warerooms at 1120 Pine Street, and will carry a complete stock of fans, motors and generators. The office will be in charge of W. L. Cummiskey, who was the western manager of the Jandus Electric Company, with headquarters at Chi-

cago and St. Louis. The territory covered by Mr. Cummiskey includes southern Illinois, eastern Missouri, Arkansas, Oklahoma, and the southwest, including northern Texas.

THE HURLEY MACHINE COMPANY, Chicago, Ill., at the recent electrical show in Chicago exhibited, for the first time, a unique washing machine that attracted a great deal of attention. The entire machine was white enameled; the wringer constructed of a white metal; the outside frame nickelplated, the only wood entering into its construction being for the cylinder. This machine is designed for architects and people who are building new homes. It can be connected permanently to hot and cold water drains.

THE MOORE LIGHT COMPANY, Newark, N. J., reports an unprecedented volume of business, the greater portion of which is in the sale of the Moore light-window for color matching, but several long-tube installations have been made recently also. Some of the more important work recently completed includes: Standard Oil Company, Bayonne, N. J.; Arlington Mills, Lawrence, Mass.; Botany Worsted Mills, Passaic, N. J.; Weidmann Silk Dyeing Company, Paterson, N. J.; the American Thread Company, Holyoke, Mass.; Baltimore Dairy Lunch, Lynn, Mass.

THE ELECTRIC STORAGE BATTERY COMPANY, Washington, D. C., describes in Bulletin No. 130 the installation of "Chloride Accumulator" for the Slate Belt Electric Street Railway Company of Pen Argyl, Pa. The railway system described is fifteen miles in length and has three cars in operation consuming a total of 100 kilowatts on the average. Grades on the road, together with the proportionately large current taken by the cars in starting so decreased the voltage as to affect seriously the schedules. The troubles were entirely remedied by the battery installation illustreated in the bulletin.

THE LORD MANUFACTURING COMPANY, New York, N. Y., announces in a recent circular letter that during the year 1909 it sold enough Earll catchers to equip all the city cars purchased in the United States and Canada, and more than enough Earll retrievers to equip all of the interurban or suburban cars purchased in the United States and Canada, and still have on their books goodly sized unfilled contracts and future orders. Never since the Earll retriever and catcher were placed on the market has there been such a demand for these devices. Aside from the enormous output in the United States they have, during this same period shipped these same devices to nearly every country on the globe, and from many of the foreign patrons they have duplicate orders.

THE WESTERN ELECTRIC COMPANY has just issued bulletin No. 1006, describing non-multiple toll switchboards. The apparatus presented in this bulletin is recommended for use in either magneto or central battery exchanges. The boards are recommended for use also as magneto exchange switchboards where a desk-type board is desired or a switchboard with a lower key-shelf than is ordinarily provided on local boards. The boards described in this publication are divided into two general types, those having self-restored line signals and those with manually restored line signals. Considerable space is devoted to the combined jacks and signals used with the first type of boards. The bulletin, which contains thirty-six pages, is illustrated with many photographs and diagrams and contains a table showing the capacity of standard types of non-multiple toll switchboards.

F. N. MANROSS, who has successfully conducted a hair spring business at Forestville, Conn., for many years, on January 1, 1911, admitted his two sons, Arthur N. and Robert H., into partnership, the firm now being known as F. N. Manross & Sons. An addition is now being built, which will greatly increase the floor space of the factory. The industry, of which Mr. Manross is the head, was started in a small way by him in about 1880, and has gradually increased until the product is now known throughout the country as the "Manross hair springs." The springs are made for electrical recording and measuring instruments, clocks, watches, steam gauges, and the close attention to this particular line of work has resulted in building up a trade which now extends to foreign countries, and the plant enjoys the unique distinction of being the largest exclusive hair spring factory in the world. The manufacture of these delicate springs requires the most careful attention, and many skilled hands are employed. All tools and appliances used have been designed and built in the factory. Springs are made to special order from silver, bronze, brass and other metals, as well as the highest grade of imported cast steel, some of the material used costing as high as $200 per pound. Mr. Manross, Sr., still retains the active management of the business.

DATES AHEAD.

Minneapolis Electrical Show, Minneapolis, Minn., January 26, February 4.

Wisconsin State Telephone Association. Annual meeting, Madison, Wis., February 1 and 2.

National Independent Telephone Association. Annual convention, Chicago, Ill., February 8, 9 and 10.

Philadelphia Electric Show, Philadelphia, Pa., February 13-27.

American Institute of Electrical Engineers, Mid-year Convention, Schenectady, N. Y., and Pittsfield, Mass., February 14, 15 and 16.

Missouri Electric, Gas, Street Railway and Water Works Association. Annual meeting, St. Louis, Mo., April 13, 14 and 15.

Iowa Electrical Association. Annual meeting, Davenport, Iowa, April 19, 20 and 21.

RECORD OF ELECTRICAL PATENTS.

Issued (United States Patent Office) January 17, 1911.

981,601. MEANS FOR CONTROLLING ELECTRICALLY-DRIVEN CENTRIFUGAL MACHINES. Comfort A. Adams, Cambridge, Mass., assignor to American Tool & Machine Company, Boston, Mass. Filed April 3, 1907. The machine is driven by a vertical shaft, direct-current, compound motor. For braking a solenoid moves a lever that short-circuits the armature, cuts out the series field and strengthens the shunt field by reducing the resistance in series with it.

981,612. STARTING DEVICE. Charles E. Carpenter, New York, N. Y., assignor to Cutler-Hammer Manufacturing Company, Milwaukee, Wis. Filed May 17, 1907. A motor-starting rheostat for a direct-current shunt motor has a no-load and an overload release, the latter being closed by an extension of the contact arm when it reaches starting position.

981,622. ELECTRIC-VEHICLE-CHARGING WALL-SOCKET AND PLUG. Jasper Newton Davis, Denver, Colo. Filed June 1, 1909. The two electrodes on the plug are of different shape to prevent wrong connection. A web extending from the center of the plug handles forms a separating barrier between the electrodes.

981,623. DYNAMO-ELECTRIC MACHINE. William F. Dawton, Schenectady, N. Y., assignor to General Electric Company. Filed May 5, 1905. In the ventilating spaces of the pole-piece are reflectors for directing the air into a centrifugal path. The armature carries vanes to confine the ventilating currents within certain limits.

981,637. HOOD-SUPPORT FOR CABLE-TERMINALS. Edwin L. Grauel, Troy, N. Y., assignor to Troy Telephone Special Company, Troy, N. Y. Filed April 9, 1910. A shunt-metal hood for a telephone-terminal box is supported by a pair of vertical rods, which are engaged by a pair of dogs.

981,641. MACHINE FOR HAIR-DRYING AND THE LIKE. Henry V. Halliwell, New York, N. Y. Filed June 23, 1910. An electric motor drives a fan revolving in a casing that has an outlet nozzle containing an electric heater.

981,646. ELECTROMAGNETIC DISPLAY APPARATUS. William A. Harvey, Scranton, Pa. Filed May 13, 1905. Beneath a horizontal diaphragm is an electromagnet whose polarity can be reversed.

981,662. TRANSFORMER FOR ELECTRICAL METAL-WORKING APPARATUS. Laurence S. Lachman, New York, N. Y., assignor to Universal Electric Welding Company, New York, N. Y. Filed Feb. 9, 1909. The secondary of a welding transformer has two rigid turns in parallel planes and arranged to move longitudinally with their work-supporting electrodes.

981,671. ELECTROMAGNETIC BRAKING MECHANISM FOR ELEVATOR-CARS. Howard M. P. Murphy, Scarsdale, N. Y., assignor to Le Roy Clark, New York, N. Y. Filed June 9, 1910. An electromagnet is flexibly connected to the car, a fixed armature therefor acting to arrest the movement of the magnet when the latter is energized. Braking mechanism connected to the car and magnet is thrown into operation upon the movement of the car with respect to the magnet.

981,683. ELECTRIC-SWITCH-OPERATING MEANS. Theophilus Pinckney, Asheville, N. C. Filed July 11, 1910. An electromagnetic track switch whose plunger actuates a reciprocating bar at right angles to it.

981,690. HEAT-DISSIPATING MEANS FOR ELECTRICAL APPARATUS. Harry A. Rhodes, Denver, Colo., assignor to Universal Motor Company, Denver, Colo. Filed Sept. 13, 1909. Between the layers of a coil are thin sheets of metal foil whose ends are slitted and bent against the metal spool ends to secure good heat conductivity.

981,692. ELECTRIC SWITCH. Howard R. Sargent, Schenectady, N. Y., assignor to General Electric Company. Filed March 19, 1900. Renewed Dec. 23, 1901. A rotary snap switch.

981,713. ELECTRIC LOCOMOTIVE. Norman W. Storer, Pittsburg, Pa., assignor to Westinghouse Electric & Manufacturing Company. Filed March 2, 1908. The floor of the central portion of the locomotives raised to form a chamber containing the upper parts of the motors, control and other auxiliary apparatus being mounted upon the raised floor.

981,718. INCASED INDUCTION-COIL. Henry C. Thomson, Boston, Mass., assignor to Electric Goods Manufacturing Company. Filed March 6, 1909. The coil is entirely incased in a cylindrical metallic casing with rounded ends through the centers of which the terminal wires pass, forming leakage-proof joints.

981,727. MEANS FOR ELECTRIC-ARC REACTIONS ON GASES. Oskar Weber and Gustav Schreiber, Griesheim, Germany, assignors to Chemische Fabrik Griesheim-Elektron, Frankfort-on-the-Main, Germany. Filed March 7, 1910. The process of subjecting gases to the action of an electric arc consists in supplying the gases to the arc in excess for the purpose of cooling, and directing them on the arc at an acute angle to its length.

981,734. SNAP-SWITCH. John A. York, Hartford, Conn., assignor to General Electric Company. Filed Aug. 12, 1907. A rotatable trip is connected to a switch bar carrying the movable contacts.

981,741. ELECTRIC LOCOMOTIVE. Hans G. Berentsen, Pittsburg, Pa., assignor to Westinghouse Electric & Manufacturing Company. Filed Jan. 10, 1910. Relates to the construction of a pony truck with hollow axles and arranged to have a swinging adjustment.

981,742. LIGHTNING-ARRESTER. Ernst J. Berg, Schenectady, N. Y., assignor to General Electric Company. Filed June 1, 1907. On each side of a reactance coil connected in series with each line wire is connected a condenser. Another set of condensers, inductively related to the first, is connected to the ground.

981,752. SPARK-PLUG. Wray Falwell, Boston, Mass., assignor of one-half to Charles H. Traiser, Boston, Mass. Filed Jan. 24, 1910. A hollow metallic shell forms one electrode.

981,759. SWITCHING DEVICE. Ford W. Harris, Wilkinsburg, Pa., assignor to Westinghouse Electric & Manufacturing Company, East Pittsburg, Pa. Filed May 9, 1908. An inclosed circuit-breaker has a horizontal shaft bearing an operating lever, one of whose ends is connected to the movable contact arm and the other is held by a latch that can be tripped by the overload coil.

981,760. PROTECTIVE DEVICE. Joseph L. R. Hayden, Schenectady, N. Y., assignor to General Electric Company. Filed April 6, 1909. An electrolytic lightning-arrester consists of a series of cells connected by U-shaped electrodes and also by V-tubes containing electrolyte.

981,764. LIGHTNING-ARRESTER. Ray P. Jackson, Wilkinsburg, Pa., assignor to Westinghouse Electric & Manufacturing Company. Filed Dec. 3, 1906. Static discharges are connected to ground through inclosed fuses, the insulating tubes of which are held in unstable equilibrium by the fuse conductors.

981,789. FLUID-MEASURING DEVICE. Samuel L. Nicholson, Pittsburg, Pa., assignor to Westinghouse Electric & Manufacturing Company. Filed Mar. 23, 1908. The throttle valve of an engine is controlled by a governor. The position of the valve is electrically recorded through a set of adjustable resistances connected to an electric instrument.

981,795. SUSPENSION MEANS FOR ELECTRIC MOTORS. Charles A. Psilander, Pittsburg, Pa., assignor to Westinghouse Electric & Manufacturing Company. Filed May 16, 1910. The motor on a locomotive pony truck is supported by two diverging spiral springs from a central point of the truck body, so as to center the truck.

981,798. FILLER FOR COILS AND THE LIKE. George H. Rupley, Schenectady, N. Y., assignor to General Electric Company. Filed Aug. 7, 1907. A filler for oil-immersed transformer windings is composed of twenty-five per cent of carnauda wax and seventy-five per cent copal gum.

981,799. ELECTRIC LOCOMOTIVE. William Schaake, Pittsburg, Pa., assignor to Westinghouse Electric & Manufacturing Company. Filed Feb. 24, 1908. An auxiliary frame carrying the axle bearings is yieldingly secured to the main truck frame through vertical posts, feet and springs.

981,803. OIL-GUARD FOR COMMUTATORS. Robert Siegfried, Pittsburg, Pa., assignor to Westinghouse Electric & Manufacturing Company. Filed Oct. 3, 1905. The cylindrical rim of the commutator spider and the V-shaped damping ring extend beyond the bolts and commutator bars.

981,806. TRACTION-ELEVATOR CONTROL. Rudolph C. Smith, Yonkers, N. Y., assignor to Otis Elevator Company, Jersey City, N. J. Filed Sept. 23, 1907. Combined with shunt elevator motor is a series starting resistance, a by-pass resistance, a number of double electromagnetic switches for varying the resistances to control the speed of the motor, a main line switch, and an auxiliary switch closed upon the opening of the main switch to close an electrodynamic brake circuit, including the motor armature and aportion of one of the resistances.

981,816. CIRCUIT-INTERRUPTER. Harvey R. Stuart, Wilkinsburg, Pa., assignor to Westinghouse Electric & Manufacturing Company. Filed Feb. 6, 1906. Combines with the movable and stationary contact members and an operating electromagnet of a circuit-breaker are means for applying a closing force to the movable member which is constant until the end of its movement, when it is slightly increased to bring the members into engagement.

981,821. CONTACT MEMBER FOR ELECTRIC SWITCHING DEVICES. Curtis A. Tucker, Edgewood Park, Pa., assignor to Westinghouse Electric & Manufacturing Company. Filed July 6, 1908. Between the terminal and the contact member is a flexible tubular shunt.

981,823. ELECTRIC SWITCH. Charles S. Van Nuis, New Brunswick, N. J. Filed Jan. 23, 1907. Has the clips secured to the base by a molded mounting, the hole in the base having opposed ribs with beveled ends, so that as the mounting contracts it will more intimately engage with the clips.

981,830. AUTOMATIC SIGN-EXHIBITOR. William Akin, Los Angeles, Cal. Filed Mar. 31, 1909. A clock-controlled electric motor moves an endless strip step by step and electric lights are flashed in the intervals.

981,840. AUTOMATIC CONTROLLING MECHANISM FOR REFRIGERATING SYSTEMS. Eugene Carpenter, Newton, and Fred M. Kimball, Somerville, Mass., assignors to Automatic Refrigerating Company, Jersey City, N. J. Filed Mar. 15, 1907. Pressure-controlled devices govern the driving of an electric motor and the latter is automatically stopped under abnormal conditions. Automatic electric signals are also associated with the outfit.

981,845. TELEGRAPHY. Patrick B. Delany, South Orange, N. J., assignor to Delany Telegraphic Transmitter Company, New York, N. Y. Filed Mar. 23, 1907. A method of transmitting messages consists in sending part of a letter or character over one circuit and another part of the letter over another circuit and uniting both parts in their proper relations at a common receiver.

981,846. KEY-SPACE. Amos F. Dixon, Newark, N. J., and Roy R. Ireland, New York, N. Y., assignors to Western Electric Company, New York, N. Y. Filed June 11, 1910. A key space for a telephone switchboard comprises a body portion provided with a notched portion at each end thereof and laterally projecting locking members located near each end of the body portion.

981,847 and 981,848. ELECTRIC CONTROLLER. Arthur C. Eastwood, Cleveland, Ohio, assignor to Electric Controller & Manufacturing Company, Cleveland, Ohio. Filed Sept. 22 and 24, 1910. The two patents cover a reversible motor controller including a set of electromagnetic switches for cutting out the series resistances and lock-out coils to prevent reversing while the motor is running.

981,857. ELECTRICAL-FUSE TONGS. Albert M. Hubbard and Charles H. Causey, St. Anthony, Idaho. Filed Jan. 8, 1910. Includes a pair of pivoted jaws pivotally mounted in an inner tube of the handle.

981,864. ELECTRIC HORN. John Lanz, Danbury, Conn., assignor to Rogers Telephone & Electric Company, Danbury, Conn. Filed Aug. 18, 1910. An electromagnet is mounted between two diaphragms so that its vibrating armature sets them into vibration.

981,865. TROLLEY-RETRIEVER. Roscoe F. Levens and Alfred H. Whatley, Providence, R. I., assignors to American Trolley Retriever Company, Providence, R. I. Filed Dec. 7, 1907. The pole is depressed by a compressed-air cylinder.

981,881. ELECTRICAL MOTOR. Harry A. Rhodes, Denver, Colo., assignor to Universal Motor Company, Denver, Colo. Filed Sept. 13, 1909. The rotor carries a set of radial electromagnets within a stationary eccentric armature. The magnets are energized as they approach the diminishing air gap, thus producing a torque.

981,897. COMBINED BRAKE AND TENSIONING DEVICE FOR TRACTION-ELEVATORS. August Sundh, Yonkers, N. Y., assignor to Otis Elevator Company, Jersey City, N. J. Filed June 24, 1907. Includes a driving motor, a brake for the motor, cable connections between the motor and the car, and means operated by the application of the brake to take up the slack in the cables.

981,900. PROCESS FOR PRODUCTION OF COMPOUNDS OF PERSULPHURIC ACID. Gustav Teichner, Nuremberg, Germany, assignor to Consortium fur Elektrochemische Industrie, Gesellschaft mit beschrankter Haftung, Nuremberg, Germany. Filed Feb. 8, 1910. Consists in subjecting solutions of sulphuric acid to electrolysis, cooling the anode and maintaining the solutions during the electrolysis at a higher temperature than the anode which is cooled.

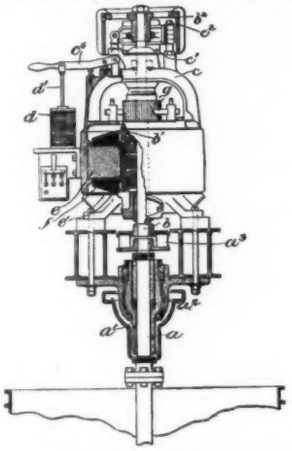
981,909. CONTROLLING APPARATUS FOR PLUNGER BRAKES. William D. Baldwin, New York, N. Y., and Floyd C. Furlow, Montclair, N. ., assignors to Otis Elevator Company, Jersey City, N. J. Filed April 16, 1908. Combined with an elevator car is a plunger connected thereto, an electromagnetic brake for

the plunger, an electric motor, an electromagnetic potential switch controlling the current to the motor, a circuit comprising the magnet coils of the brake and switch, and means for controlling this circuit.

981,919. SAFETY DEVICE FOR ALTERNATING-CURRENT HOISTING APPARATUS. William N. Dickinson, Jr., New York, N. Y., assignor to Otis Elevator Company. Jersey City, N. J. Filed June 14, 1906. Comprises a motor, controlling means, a safety device, and a switch operated by the motor and coacting with the controlling means to effect the operation of the safety device to stop the motor when the latter rotates in a contrary direction.

981,922. ELECTROLYTIC SHIP-CLEANER. George W. Frazier, Pittsburg, Pa.; Mary E. Frazier, administratrix of said George W. Frazier, deceased, assignor to Pittsburg Electrolytic Manufacturing Company. Filed Nov. 28, 1908. Renewed June 6, 1910. The metal hull of the ship acts as one electrode and the other is mounted on a floating and independently movable body.

981,930. ALTERNATING-CURRENT POTENTIAL SWITCH. David Larson, Yonkers, N. Y., assignor to Otis Elevator Company, Jersey City, N. J. Filed May 7, 1908. Comprises a base, a magnet coil, a magnet frame secured to the base and having a pole piece extending into the coil, a switch arm made of magnetic



981,601.—CONTROL FOR CENTRIFUGAL MOTOR.

material, a pole piece carried by the coil and movable into it, and means for completing the magnetic current outside of the coil and through the switch arm.

981,931. ALTERNATING-CURRENT ELECTROMAGNETIC SWITCH. David L. Lindquist, Yonkers, N. Y., assignor to Otis Elevator Company, Jersey City, N. J. Filed May 7, 1908. Means are provided for opening the switch, a strong spring acting as a resilient abutment while the switch is closed. A spring closes the switch when released.

981,935. ELECTRIC BRAKE FOR GRAPHOPHONES. John F. Means, Oil City, Pa. Filed April 18, 1910. An electromagnetic brake is mounted in the graphophone box.

981,987. ELECTRIC CIGAR-LIGHTER. Victor Emmanuel Extrom and Thomas Graham Boardman, Tomahawk, Wis. Filed Mar. 25, 1910. Comprises a metallic stand in which is mounted a small transformer in the secondary circuit of which is connected the resistance wire. The circuit is closed by means of a push button.

981,989. CHRONOGRAPH. Theodore T. Fitch, Washington, D. C. Filed July 17, 1909. A cylinder, on which is wrapped the recording a sheet, is turned at a uniform speed by a motor. A second motor makes a time record on the sheet and a timing device common to both motors controls their operation.

981,996. TEMPERATURE-ALARM. Albert Goldstein, New York, N. Y., assignor to International Electric Protection Company. Filed March 28, 1910. Comprises a pipe in loop form having open ends, diaphragms respectively disposed in front of the ends, terminals in proximity to the diaphragms, and means for electrically indicating a change in the contact relation between each diaphragm and its associated terminal.

981,997. SIGNAL-TELEGRAPH. Albert Goldstein, New York, N. Y., assignor to International Electric Protection Company. Filed March 28, 1910. A succession of current impulses is sent over a line, a single device being provided at the transmitting station for regulating the number of impulses. There are controlling devices respectively controlling the regulating device to cause the transmission of predetermined and different numbers of impulses in an arbitrary order.

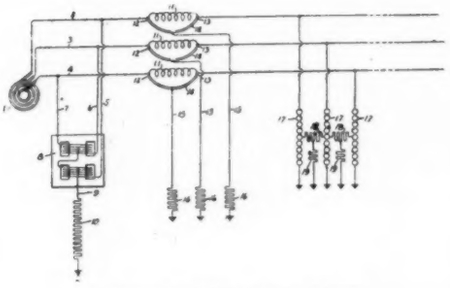
981,998. ELECTRICAL THERMOSTATIC ALARM SYSTEM. Albert Goldstein, New York, N. Y., assignor to International Electric Protection Company. Filed May 2, 1910. Comprises an electric circuit, an alarm device, controlling means operated in two steps by successive changes in the electrical condition of the circuit, and means for producing such changes.

982,011. VACUUM-RENOVATOR. Augustus W. Nohe, Chicago, Ill., assignor to Nohe Electric Home Renovator Co., Chicago, Ill. Filed June 26, 1909. A self-contained vacuum cleaner is driven by an electric motor.

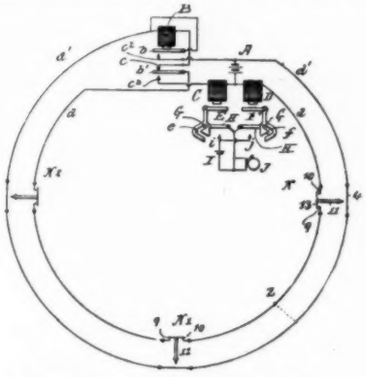
982,032. CONTROL OF ELECTRICALLY-OPERATED SWITCHES. Eugene R. Carichoff, Schenectady, N. Y., assignor to General Electric Company. Filed Sept. 19, 1910. Comprises a number of contactors intended for operation in succession, two actuating circuits leading to alternate contactors, relay mechanism for energizing the actuating circuits alternately, and connections whereby the resistance of the actuating circuits is alternately decreased upon the successive operation of the relay mechanism to cause the contactors to close successively.

982,033. EMERGENCY OPERATING MEANS FOR REVERSING-SWITCHES. Frank E. Case, Schenectady, N. Y., assignor to General Electric Company. Filed Sept. 30, 1909. An electrically operated reverser is combined with a switch operated by fluid pressure. Valve mechanism for operating the latter is connected with the handle of the controller.

982,037. ELECTROLYTIC CELL. James R. Crocker, New York, N. Y., assignor to McDonald Electrolytic Company, New York, N.



981,742.—LIGHTNING ARRESTER.



981,998.—THERMOSTAT ALARM.

Y. Filed Sept. 30, 1909. An electrolytic cell suitable for the electrolysis of sodium chloride or similar salts has a cast metallic body, inclined ribs forming lateral cathode chambers, and diaphragms engaging the ribs.

982,041. MOTOR CONTROL. William N. Dickinson, Jr., New York, N. Y., assignor to Otis Elevator Company, Jersey City, N. J. Filed July 3, 1906. A brake-releasing magnet of the multiphase type is so arranged as to allow the brake to act on the motor as soon as current is cut off, but is so connected with the reversing switch that the operation of the switch is almost simultaneous with the completion of the magnetic circuit of the magnet.

982,045. ELECTRIC VULCANIZER. Walter C. Fish and Arthur M. Stanley, Lynn, Mass., assignors to General Electric Company. Filed Sept. 12, 1907. A tire vulcanizer comprising a circular casing composed of segmental sections and a number of electric heating units mounted at intervals around the circumference of the casing.

982,052. ELECTRICAL SYSTEM FOR THE SUPERVISION OF WATCHMEN. Albert Goldstein, New York, N. Y., assignor to International Electric Protection Company. Original application filed May 10, 1910. Divided and this application filed July 22, 1910. Comprises a line circuit and an automatically operating transmitter, a translating device, a second transmitter, and a manually operable circuit-closer disposed in a crossing between the line members and at the supervised station for independently controlling the second transmitter.

982,067. ALTERNATING-CURRENT-MOTOR CONTROL. John D. Ihlder, New York, N. Y., assignor to Otis Elevator Company, Jersey City, N. J. Filed Jan. 15, 1907. Auxiliary resistance and starting resistances are provided and means for effecting a successive insertion of the starting resistance and the cutting out of it, and a device for cutting out the auxiliary resistance upon the insertion of the starting resistance.

982,074. SAFETY SLOW-DOWN AND STOP MOTION FOR ELECTRIC ELEVATORS. David Larson, Yonkers, N. Y., assignor to Otis Elevator Company, Jersey City, N. J. Filed May 18, 1909. The safety device contains two switches in parallel and a circuit-breaker which operates to slow down the elevator when both switches are open.

982,097. ELECTRODE FRAME AND HANGER. Charles B. Schoenmehl, Waterbury, Conn. Filed Feb. 9, 1910. A device for suspending the negative plate of a battery.

982,100. SOLENOID-OPERATED SWITCH. Henry L. Smith, Schenectady, N. Y., assignor to General Electric Company. Filed June 8, 1906. A solenoid switch operates in a chamber partly filled with oil.

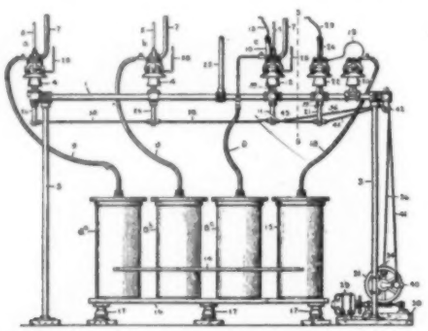
982,110. OUTLET-BOX-SUPPORTING BRACKET FOR ELECTRIC-WIRING FIXTURES. Sol Adelman, Chicago, Ill. Filed Mar. 15, 1910. Comprises a thin metal bracket fastened to an outlet box.

982,116. CIRCUIT-BREAKER. Henry Price Ball, New York, and Gilbert Wright, Schenectady, N. Y., assignors to General Electric Company. Filed June 17, 1908. A calibrating device for electromagnets includes an operating handle for the circuit-breaker and an electromagnet having an armature responsive to abnormal current to trip the circuit-breaker. An adjustable stop is provided for the armature, and means controlled by the handle lock the stop in adjusted position.

982,119. VAPOR ELECTRIC APPARATUS AND METHOD OF OPERATING THE SAME. Charles Orme Bastian, London, England. Filed April 28, 1910. A solid metallic positive electrode is used in connection with the mercury electrodes in a vapor electric apparatus to operate at high temperatures.

982,146. ELECTROMAGNETICALLY-OPERATED SWITCH. Charles B. Larzelere, Seneca Falls, N. Y., assignor to General Electric Company. Filed Aug. 2, 1910. Comprises a relay, a latch mechanism for holding the relay open, and a mechanical connection which connects the contactor and the relay and the latch mechanism whereby the contactor in opening opens the relay contacts and in closing trips the latch mechanism.

982,175. ELECTRICAL AGRICULTURAL SYSTEM. Charles S. Doney, Columbia Falls, Mont., assignor of one-third to Charles H. Foot, Kalispell, Mont., and one-third to George D. Watt, Columbia Falls, Mont. Filed April 5, 1910. The two lines of a power circuit are run at the two sides of a field and current for operating agricultural machinery is taken from three lines by trolley wheels carried on portable stands.



982,224.—ALUMINUM-CELL LIGHTNING ARRESTER.

982,188. TELEGRAPH-POLE. Joseph H. Norton, Mullinville, Kans. Filed Oct. 25, 1909. A concrete pole has reinforced concrete cross-arms with insulator pins embedded therein.

982,193. OUTLET-BOX. Fred Irving Thayer, Farmington, N. H. Filed Sept. 15, 1910. An outlet-box is made so that it can be attached to a stud on one side and to the laths on the other.

982,209. BRIDGING TELEPHONE SYSTEM. Henry F. Joeckel, Camp Point, Ill. Filed Feb. 21, 1910. Comprises a metallic line circuit and a magneto-call local-battery bridging telephone with an additional signaling line circuit consisting of a metallic conductor and a ground return circuit, which is insulated from the usual metallic talking line circuit.

982,213. TELEPHONE SWITCH APPARATUS. Stanislaw A. Koltonski, Boston, Mass., assignor to Electro Mechanical Works, Boston, Mass. Filed Jan. 21, 1910. A separable two-part frame carries the switching devices consisting of the plungers and the movable receiver hook, and groups of circuit springs adapted to be operated by the plungers and also a group of circuit springs adapted to be operated by the receiver hook.

982,222. ELECTRIC-DROP-LIGHT HANGER. Henry Uhl and Ulysses S. Grant Barnhart, Longmont, Colo. Filed April 16, 1910. The lamp cords wound on a roller actuated by a coiled spring, so that the length of the cord may be regulated as desired.

982,224. LIGHTNING-ARRESTER. Elmer E. F. Creighton, Schenectady, N. Y., assignor to the General Electric Company. Filed July 6, 1909. Combines in a three-phase system having three conductors, four electrolytic condensers with corresponding terminals electrically connected and the other terminals of two of the condensers directly connected to two conductors, and means whereby either of the remaining two condensers may be connected to ground and the other connected to the third conductor.

982,227. APPARATUS FOR PRODUCING OZONE. Ludwig Glaser, Schenectady, N. Y., assignor to General Electric Company. Filed July 20, 1907. A conductor of the second class is cooled by strong air currents, and a resistance with high positive temperature coefficient is connected in series with the conductor to prevent it from losing its conductivity because of the cooling action of the strong air currents.

982,228. MERCURY-VAPOR APPARATUS. John T. H. Dempster, Schenectady, N. Y., assignor to General Electric Company. Filed Mar. 6, 1905. Comprises a resilient diaphragm of conducting material, an electrode electrically connected thereto, automatic means for moving the diaphragm, and means for maintaining a pressure less than atmospheric on both sides of it.

PATENTS THAT HAVE EXPIRED.

Following is a list of the electrical patents (issued by the United States Patent Office) that expired January 23, 1911:

513,109. ELECTRIC RADIATOR. Walter D. Hough and Elmer Z. Burns, Niagara Falls, N. Y.

513,111. ELECTRIC ARC LAMP. William Jandus, Cleveland, O.

513,112. GAS AND ELECTRIC COUPLING. William J. Kelly, Boston, Mass.

513,113. ELECTRIC-LIGHT FIXTURE FOR MUSIC STANDS. William J. Kelly, Boston, Mass.

513,122. ELECTRIC SAFETY DEVICE FOR ELEVATORS. Robert W. Magrane, Brooklyn, N. Y.

513,134. ELECTRIC ELEVATOR. Norton P. Otis, Yonkers, N. Y.

513,164. TELEPHONE-INDEX. Arthur N. Webb, Salem, Mass.

513,213. ELECTRIC MOTOR CONTROLLING DEVICE. Jere E. Stanton, Boston, Mass.

513,219 and 513,220. ELECTRIC BELL. Charles Turnbull, Jr., North Shields, England.

513,231. SWITCH AND SIGNAL APPARATUS. Frank L. Dodgson, Rochester, N. Y.

513,245. SECONDARY BATTERY. Evelyn Paget and Leonard Paget, New York, N. Y.

513,250. ELECTRIC-LIGHT CUT-OFF. Joseph B. Stewart, Maverstraw, N. Y.

513,251. ELECTRO-MECHANICAL GONG. Nathan H. Suren, New York, N. Y.

513,259. AUTOMATIC ELECTRIC STOP MOTION FOR KNITTING MACHINES. Jules Buchel, New Orleans, La.

513,262. ELECTRICAL TIME SIGNALING APPARATUS. James H. Gerry, Brooklyn, N. Y.

513,264. ELECTRIC METER. John C. Henry, New York, N. Y.

513,270. PROCESS OF AND APPARATUS FOR MELTING METALS BY MEANS OF ELECTRICITY. August F. W. Kreinsken, Hamburg, Germany.

513,294. ELECTRICAL APPARATUS FOR FIRING SUBMARINE MINES. Giulio Bertolini, Venice, Italy.

513,299. COIN-OPERATED TELEPHONE SWITCH. Charles F. Brown, Yarmouth, Canada.

513,300. ELECTRIC GAS LIGHTER. Winsor L. Brown, San Francisco, Cal.

513,305. TELEPHONE TRANSMITTER. Frank R. Colvin, New York, N. Y.

513,345. ELECTRIC CALL BELL FOR PNEUMATIC TUBES. Leopold Strouse, Baltimore, Md.

513,347. MAGNETO-ELECTRIC MACHINE. Horace H. Taylor, Los Angeles, Cal.

513,349. MEANS FOR NEUTRALIZING SELF-INDUCTION IN ALTERNATING CIRCUITS. Elihu Thomson and Edwin W. Rice, Jr., Swampscott, Mass.

513,350. AUTOMATIC RHEOSTAT. Burton C. Van Emon, San Francisco, Cal.

513,364. APPARATUS FOR REGISTERING TELEPHONE CALLS. Ludwig Kahn, Hamburg, Germany.

513,376. RAILWAY SIGNALING APPARATUS. Eduard A. Winterhalder, Kappel, Germany.

513,387. ELECTRIC BELT. Willie C. Fuller, Salina, Kan.

513,391. ELECTRIC METER. Charles Gudgell, Independence, Mo.

513,401. ELECTRIC MOTOR FOR STREET-CARS. Benjamin G. Lamme, Pittsburg, Pa.

513,422. MEANS FOR COOLING ELECTRIC CONDUCTORS. Henry A. Rowland, Baltimore, Md.

513,425. SELF-INDUCTION COIL. Charles F. Scott, Pittsburg, Pa.

513,426. SPAN-WIRE FOR OVERHEAD ELECTRIC RAILWAYS. Sidney H. Short, Cleveland, Ohio.

513,440. SUPPLY SYSTEM FOR ELECTRIC RAILWAYS. Henry S. Pruyn, Hoosick Falls, N. Y.

513,457. RESISTANCE-COIL. Harry P. Davis, Pittsburg, Pa.

513,459. DYNAMO-ELECTRIC MACHINE. George F. Dieckmann, Chicago, Ill.

513,460. COMMUTATOR FOR DYNAMO-ELECTRIC MACHINES. Harry L. Fee, New Orleans, La.

513,466. ELECTRICAL MEANS FOR PROPELLING CANAL-BOATS. Joseph Sachs, New York, N. Y.

513,469. ELECTRIC CLOCK SYSTEM. James H. Gerry and Frederick M. Schmidt, Brooklyn, N. Y.